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NUTRITION HYGIENE PHYSIOLOGY

BOOK TWO

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Charles William Eliot

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BOOK TWO

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NUTRITION—HYGIENE—PHYSIOLOGY

BOOK TWO

By

HARVEY W. WILEY, M.D.

Formerly chief chemist of the United States Department of Agriculture. Editor of "Good Housekeeping's" Bureau of Foods, Sanitation, and Health. Author of "Foods and Their Adulterations," "Principles and Practice of Agricultural Analysis," "The Lure of the Land," "Not by Bread Alone"

Illustrated by

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HEALTH READER

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A FOREWORD

I believe it was George Ade who said, "If you want to uplift, get beneath." This sentiment is peculiarly applicable to the study of physiology in the schools. Such terms as "anatomy," "physiology," and "hygiene" terrify the children, and to a certain extent make them antagonistic to the study. I have long thought that the proper way to get children interested in this matter was to make the subject a living one. I have sought to get entirely under it and to present it in a vital way. My experience is that children are easily interested in matters that pertain to their daily life if we go at it in the proper spirit. Instead, therefore, of the dry details of physiology, I have tried to lead the child into the midst of the phenomena of the life he is living and to tell him in simple language of the character of the environment in which he lives.

I begin by taking him outdoors and allowing the wind to blow in his face. I lead him to the fireplace and let him warm his fingers. I take him to the spring and show him the water that he drinks. I go with him into the fields to watch the growing food. I visit with him the mills where this food is being prepared for consumption. I tell him of those things which are vitally related to his daily life and which are the groundwork of his health and growth. I have endeavored to put the material into the form in which the child naturally absorbs it. The child is an interrogation point. He asks questions. I have taken the questions which have been suggested to me by talking with children, and have tried to answer

the questions they have put to me. While this method of preparing a physiology is novel and radical, to my mind it seems natural and workable. With the help of the teacher the child will at once become interested in the phenomena of existence. The study will not be a burden, but a revelation and a pleasure.

While it has seemed advisable in some places to use words which children do not understand, their meanings have been given so that they may know what they are reading about. The dry details of the usual form of study on this subject have been entirely eliminated. The child who reads this book properly under competent instructors will have a new view of life, a better understanding of his environment, and a clearer conception of what is good for his health. He will be asking himself continually, when new duties and new pleasures present themselves, or new foods come to his attention, this question: Is it good for me?

HARVEY W. WILEY

Washington, D.C.
April, 1916

An ideal meal for the growing child. Whole-wheat bread, milk, and fruit

WILEY'S HEALTH SERIES

BOOK TWO

I. Food and Why We Need It

What is food? That is a very important question. Food is necessary to life. Without it we should soon die of starvation. The work of men is largely done in order to obtain food. Food is necessary also to health and growth. Without proper food the child cannot grow as he should. No one, young or old, can be healthy without suitable food. Every one who studies, plays, or works must be properly nourished. In all our plans for life and happiness, food must be considered.

Every person is at his best only when supplied with good food. The family cannot do its work at home or in society unless it is supplied with good food. The community cannot become prosperous and progressive without good food. The state would fail in its efforts to establish good government and protect the rights of its inhabitants without an abundant food supply. The nation engaged in war cannot continue fighting for any length of time without a large food supply. The most progressive races of men are those that have good food in plenty. Thus, from every point of view, we

find that food, above all things except air and water, is necessary to life, to effective work, and to happiness.

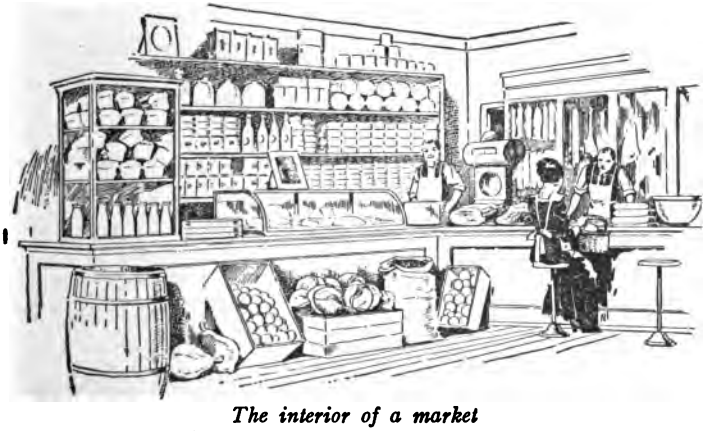
For this reason the answer to the question, What is food? is of great importance: *Food is that which, taken into the body, promotes growth, restores waste tissue, and provides heat and energy.*

QUESTIONS TO HELP THE PUPIL

1. Why is food so important? 2. Is good food necessary to health? 3. What would happen if we did not get enough food? 4. Is effective work or happiness possible without plenty of good food? 5. What other things besides food are absolutely necessary to life? 6. What is the function of food in the body?

II. The Articles of Food

What are the articles which serve as food? We all know from everyday experience what is generally regarded as food. When we speak of food we think of milk, bread, meat, fruit, and vegetables, for the food we eat consists largely of these articles. There are still other articles which serve as foods though they are not usually thought of as such. In the first place, water forms an important part of the foods we consume. And, in that sense, water is a food, though we usually speak of it as a *beverage*. Again, the oxygen of the air plays an active



The interior of a market

part in nourishing the body, and especially in providing heat and energy. To that extent

the oxygen which enters the lungs is really a food, though it is not included under what we commonly term food.

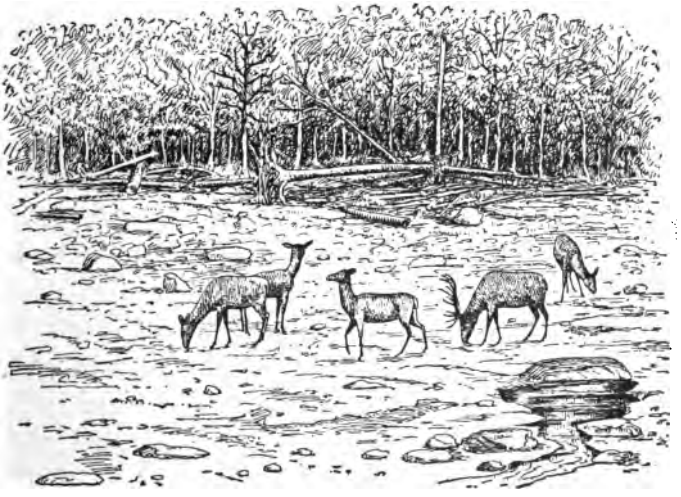
There is another class of articles, called *condiments*, used chiefly to give relish or seasoning to food. Some condiments are foods and others are not. Common salt, for instance, is a condiment; but it is also a food, since it is necessary to the proper nourishment of the body.

Are useful substances ever harmful? When used in too large quantities common salt, instead of being useful, becomes harmful. This is true of every good substance. You can drink so much water that your blood becomes diluted. This increases the bulk of the blood, and so places a heavier burden on the heart, the arteries, and the veins, and also on the kidneys and other *excretory organs*, which separate or discharge waste and harmful material from the blood or tissue. In this way water becomes harmful. You can eat enough bread to overload your stomach and so cause indigestion. You can drink so much milk that you will be made ill. And so with every good thing. Its right use is beneficial; its wrong use is harmful.

Why should we avoid useless substances? There is a great difference between articles which are useful and good when not used to excess, and those which in themselves are useless

and also harmful. Because common salt is harmful when too much is used is no excuse for using *benzoate of soda*, a common food preservative, which never does any one any good no matter what the quantity used. A useless substance in the body, no matter how small the quantity, must be harmful since the energy of the body must be used in some way to get rid of it. In the long run any useless expenditure of energy is harmful.

Are we in danger of eating too much salt? Salt is often used in foods which would be better



Deer at a salt lick

without it. An instance of this is its use in butter. In this country we are accustomed

to salted butter; in other countries it is served unsalted. If we used unsalted butter we might soon learn to like it better than when salted.

We are also inclined to use too much salt on our meats. The proper place to use salt is with our vegetable foods. Animals that live on vegetables require more salt to enable the organs of the body to perform their proper functions than those that live on meats. Wild plant-eating animals, such as the buffalo and the deer, will travel many miles in order to reach a salt lick, a place where salt is found on the surface. Those of you who live on farms are familiar with the general custom of giving salt to sheep, horses, and cattle. On the other hand, flesh-eating animals, such as dogs and cats, do not require much salt. This is because there is naturally much salt in all flesh and very little in vegetables, and because plants contain much potash which common salt helps to eliminate.

A farm smokehouse

The desire for an excessive amount of salt in our food is largely a matter of habit which can easily be overcome.

Are there other condiments in foods? There are many condiments besides salt used in foods. Some of these, such as mustard and some forms of pepper, have a certain amount of food value. Others, such as vanilla and other flavoring extracts, have little or no food value. The principal condiments are salt, pepper, mustard, cinnamon, ginger, and the flavoring extracts.

A particular flavoring substance is developed by burning wood. This substance, which is present in the smoke from the burning wood, is regarded as a condiment and is usually classed as such. Ham and bacon owe their flavor in part to this condiment.

Not salt alone, but all condiments, may become injurious if used to excess. But when properly used they are beneficial, for condiments induce an increased flow of the liquids that aid digestion.

QUESTIONS TO HELP THE PUPIL

1. What are the common articles of food? 2. Is water a food? 3. Is oxygen called a food? 4. Name another class of foods. 5. When do useful substances become harmful? 6. Why is benzoate of soda harmful? 7. What can you say about the quantity of salt generally used? 8. With what kind of food is it most proper to use it? 9. What animals need salt? Why? 10. Name some animals that do not require much. Why? 11. Name some condiments besides salt. 12. What must we avoid in the use of condiments? 13. Why are condiments beneficial when properly used?

III. The Flavor of Foods

What is flavor in food? Flavor in food is a combination of taste and odor. We get it through the combined action of the tongue and the nostrils. It is not correct to say that we get the flavor of food through the mouth alone or through the nose alone. What we get in the mouth is the taste, and what we get through the nostrils is the odor; the combination of the two is flavor. For instance, sugar alone has a taste but no odor, while vanilla is especially valued for its odor. But by combining sugar and vanilla we get a pleasing and distinct flavor. We all know this fine flavor in cake we have eaten.

Flavor is an important element in the proper digestion of food. If we were to take our food through a tube inserted into the stomach, which is entirely possible, we should get from it neither a sense of smell nor a sense of taste. At the same time our digestion would be greatly impaired and the food would not properly nourish the body. Thus the forcible feeding of prisoners who try to commit suicide by starving themselves may save their lives, but it does not give them the full benefit of the food.

Condiments all affect either the sense of taste or the sense of smell, and usually both.

Condiments, therefore, are important aids to digestion, because they produce or heighten food flavors.

Do foods themselves have flavors? Yes, most food products have flavors. Those that have well-marked flavors do not need the addition of a condiment. Good types of such foods are the apple and the orange. These products have not only an agreeable odor but also a pleasant, sweet-acid taste. This combination of odor and taste produces a fine flavor.

No one should think it necessary to add any condiment to such fruits in order to produce flavor. The addition of pure sugar is not the addition of a flavor, because refined sugar, having no odor, does not fall within the definition of a flavor. When cooked, acid fruits are often sweetened with sugar, and sometimes condiments, like cinnamon or nutmeg, are added for flavoring purposes. But in the raw state, and it is thus that the fruits have their best flavors, such additions would be out of place. Practically none of the common foods we eat in the raw state needs condiments. Melons, berries, and nuts all have distinctive flavors and are for the most part eaten without condiments. Some nuts are improved to the taste of many persons by the addition of salt, but few are really made better thereby.

Does cooking develop flavor? Cooking or roasting develops flavor in a great many substances without the addition of condiments, though it is to the cooked foods, most of all, that condiments are added. Some common examples of flavor developed by roasting are found in the coffee bean and in peanuts. The peanut, though edible in the raw state, is far more agreeable to eat when it is roasted. The roasting develops taste and odor—that is, flavor. The coffee bean has a better and an entirely new flavor after being roasted. In fact, a drink made from the raw coffee bean would not appeal to the taste. The flavor of meats is always brought out to a great degree by roasting. This is true also of bread when it is baked.

A street peanut roaster

Condiments affect the nerves of taste, which are in the tongue, and also the nerves of smell, which are in the nostrils. These nerves are connected directly

and indirectly with the digestive organs. A good taste and a good odor in food aid in exciting the activity of the digestive organs.

Jaw and mouth, showing salivary glands
a, parotid glands; *b*, submaxillary glands; *c*, sublingual glands; *d*, salivary ducts; *e*, tongue

When you are very hungry, and you get the odor of the dinner being cooked, your mouth waters. That is, the nerve of smell — the *olfactory* nerve — has carried a message to the *salivary* glands that something good is coming, and these glands, which discharge saliva into the mouth, get ready to welcome the visitor. In other words, your "mouth waters." Then when you place on the tongue a bit of food that tastes good, the nerve of taste sends a message to the glands in the stomach that secrete the *pepsin*, and those glands get ready to aid in digesting the food. If you put butter on your bread and get both the taste and the odor of butter, these nerves send a message

to the large gland called the *pancreas*, which discharges into the intestines, and the pancreas prepares to welcome the visitor by secreting the fluid which will digest the fat. Thus, through odor and taste, all the organs which are active in the digestion of food receive advance notice of the approach of the food and make preparations to do their part in its digestion.

Is there danger in using condiments too freely? The answer to this question is the same as that in regard to salt. In order to avoid excess, condiments should be used sparingly, with judgment, and with great care. The skilled French cook, instead of putting onion directly into his sauce, will simply rub the spoon with which the sauce is served with an onion. He thus gets a fine, delicate flavor, instead of the full strength of the onion. The proper use of condiments is a mark of the skilled and experienced cook. Those not skilled in the use of condiments should make up for their lack of knowledge by using them in very small amounts.

The onion plant

lity to use the heat of the oven in

developing taste, odor, and flavor is also a marked characteristic of the good cook.

Are condiments regarded as food products? Condiments are not commonly regarded as food products. But in the law of our country everything we consume for our nourishment or pleasure is regarded as food. According to the Food and Drugs Act of the United States food includes not only those things which are commonly considered as food, but also beverages, condiments, and confections. This law is usually called the "pure food law" because it requires that all articles of food made or put up for sale be clean and pure.

"Ruby" pepper

QUESTIONS TO HELP THE PUPIL

1. What is the flavor of a food? 2. Does flavor aid digestion? 3. How do condiments aid digestion, if used properly? 4. Should condiments be added to raw fruits? 5. What food substances have their flavor developed by roasting? 6. In what quantities should condiments be used? 7. What is the "pure food law"?

8. What nerves do condiments affect? 9. With what are these nerves connected? 10. What happens when you smell a good dinner or taste a good food?

IV. Differences in Foods

How do foods differ? No two foods are exactly alike. Even if of the same variety there may be great differences between them. All the foods we eat, even those of the same kind, vary according to the locality in which they are grown, the conditions of climate or season, and the methods used in harvesting and handling them. A pippin (one kind of apple) grown in Virginia may be quite unlike a pippin grown in California, though both apples grew on the same kind of a tree. The environment in which food grows — in other words, air, sunshine, rain, and soil — has a great deal to do with its character as well as the kind of food it represents.

An apple

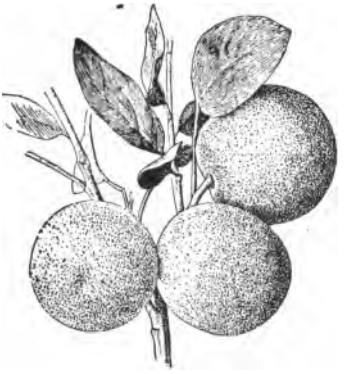
Foods differ in many other respects. It is very important that we understand in a practical and simple way just what some of these differences are.

What are the most common articles of food? In general, when we sit down at a table we expect to have bread. A meal without bread, though such meals are sometimes served, never seems quite complete. Especially is this true of

the home table. Bread may be considered a universal food among all nations where the art of bread making is known. Under the term "bread" we include the many varieties of foods made from such cereals as wheat, Indian corn, oats, and rye.

Another article we usually expect to have at a meal, especially at dinner, though it is not so universally eaten, is meat. Under the term "meat" we may include as many different kinds of products as we do under the term "bread."

A third article we are usually given at a meal is a vegetable of some kind. In common language the term "vegetable" is not applied to all plant-food products. Potatoes, green peas and beans, radishes, and beets are thought of as types of the class of foods we commonly call vegetables.



Oranges

Our ideas of a meal, in other words, lead us to think at once of three great classes of food: *bread*, *meat*, and *vegetables*. It would not be fair to leave out fruit, although fruit is not nearly so commonly served at meals as vegetables. It

would be well if it were used more. A true saying is, "An apple a day keeps the doctor away." It is unfortunate that so large a number of our people do not have the privilege of eating fruit every day. It would be wise for the one who provides for the table to serve less meat and more fruit and vegetables.

May foods be classified in other ways than as bread, meat, vegetables, and fruit? These terms, bread, meat, vegetables, and fruit, are used to denote the articles usually thought of as foods. But regarded from the scientific point of view, the term "food" applies to the elements of nourishment which these articles contain rather than to the articles themselves.

We have in our bodies certain tissues — namely, bones, muscles, tendons, nerves, brain, skin, and hair. These tissues have different characteristics; that is, they are made up of varying amounts of different kinds of elements and require different kinds of nourishment. The scientific view of nutrition is to feed these tissues the elements of nourishment they need, selecting from among the different articles of food those which most nearly supply their wants.

There are four principal foods, or elements of nourishment, necessary to the sustenance of the body. First, starches and sugars, together

known as *carbohydrates*, a word which means "water united with carbon."

Sugars are much more *soluble*, or easily dissolved, than starches. They are extremely soluble in water, while starches are scarcely at all soluble in cold water and only to a limited degree in hot water. If you boil a little starch with water it seems to dissolve, but as a matter of fact the starch is only suspended in the water in the form of a paste. If you put sugar in water the sugar rapidly disappears, and exists throughout the water in a state of complete solution.

As foods, sugars and starches are much alike; they serve the same purpose in the body, and together they constitute by far the largest part of our food.

What are the principal starch foods used? The cereals — wheat, corn, barley, rye, rice, oats, buckwheat — form with potatoes the principal food supply of man. They are also the most important starch foods he uses. In some countries, as in rice-eating China and Japan, cereals provide almost all the food supply. In other countries the principal article of food is made from rye, as in Russia and in parts of Germany. In still other countries, like France, England, Scotland, the United States, and Canada, the principal cereal products used for food are wheat and oats.

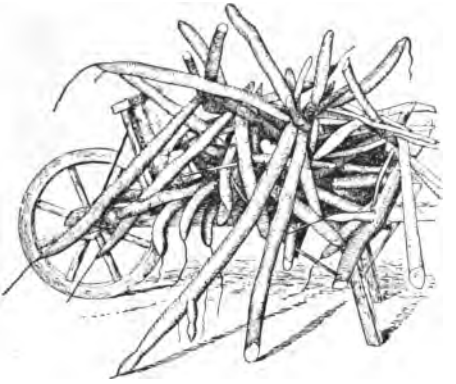
Cereals in general, when ground into flour or meal, contain seventy per cent of starch and twelve per cent of water, although certain cereals vary somewhat from these figures. Thus it is evident that when cereals are eaten the great bulk of the food is composed of starch.

The sago palm

Among other starch foods the potato contains about twenty-two per cent of solid food and seventy-eight per cent of water. Of the twenty-two per cent of solid food more than three fourths is starch. Peas and beans also contain considerable quantities of starch, though in these articles the starch is not the principal ingredient. There are certain other foods — such as the *cassava*, which grows in Florida and the tropics; the *taro*, a starchy food which grows abundantly in the Hawaiian Islands; and *sago* — the food elements of which consist largely of starch.

Thus we learn that the principal starch foods are cereals, potatoes, sago, cassava, and taro.

From what products do we get the principal sugar foods? Practically all the foods we eat contain sugar. Some of them, such as the cereals, contain an exceedingly small quantity of sugar, not over one or two per cent. Others, like the refined sugars we buy, consist almost entirely of sugar, the percentage being about 99.95. We eat sugar in two forms, first as an element of our common foods. In this we have no choice; we must eat the sugar if we wish to eat the foods. Second, we eat sugar that has been extracted from plants and prepared for our use in the form of molasses, sirups, raw sugar, and refined sugar. We eat these simply as sugars, or after they have been added to pastry, confections, and candies.



Cassava roots, from which tapioca is made

Among the foods that are rich in sugar, milk may be mentioned first. Milk contains from five to eight per cent of sugar, according to the kind of milk. Ordinary cow's milk contains about five per cent of sugar. Beets, especially sugar

beets, contain a large amount of sugar, sometimes as much as fifteen to eighteen per cent. Turnips, radishes, and carrots contain from two to five per cent. Fruits of all kinds contain a large amount of sugar, from seven to fifteen per cent, and some kinds of grapes contain even more.

A sugar beet

Thus, whether we eat cereals, drink milk, or eat vegetables or fruit, we are continually taking into our stomachs large quantities of sugar. When we eat cakes, pastry, confections, and candy we take still greater quantities. Some of these latter foods are composed almost entirely of sugar. So far as digestion and nutrition are concerned, sugar and starch have the same properties and may be considered as one and the same substance.

What relation has sugar to health? A large amount of sugar in the food tends to make one fat. Sugars and starches are regarded as even more likely to cause *obesity* or stoutness than fat or oil. People who are inclined to become fat should eat as little sugar as possible. They ·ld not put it on the cereal at breakfast

nor use it with strawberries and cream at lunch, and they should avoid ice cream at dinner. An excess of sugar in the body is dangerous. The alarming increase in this country of the disease called *diabetes* may possibly be due in a degree to the large increase in the consumption of sugar. For the same reason candy eating among children is extremely injurious to their health. Sugar may make children fat, but it does not make them healthy. They get all the sugar they need in their usual food. Too much sugar and candy also prevent the development of good teeth. Children should not eat candy.

After starch and sugar, what is the next important food element? Judged by the quantity in which it occurs in food products, the most important food element after the carbohydrates, starch and sugar, is what is known as *protein*. Protein is the name given to that class of foods, so important in human nutrition, which contains as two of its distinctive elements *nitrogen*, meaning "niter producer," and *sulphur*. Many of the proteins contain other important nourishing elements also, as for instance *phosphoric acid*, used in forming bones and teeth. A pure protein, however, may not contain any phosphoric acid, but may consist entirely of nitrogen, sulphur, hydrogen (water former), carbon (coal), and oxygen (acid former). Usually a pure

protein, such as dried white of egg, which is about the purest form known in nature, contains about sixteen per cent of nitrogen and one per cent of sulphur. The other eighty-three per cent are composed of hydrogen, oxygen, and carbon. The principal sources of the protein in our foods are the cereals, and after them especially the lean meat, red or white, of all edible animals, and lastly eggs, peas, and beans.

What is the third important food element? Judged by quantity alone, the third important food element is fat or oil. The butter and lard, olive oil, cotton seed oil, and other edible oils which we consume with our foods consist very largely of fat and oil. Of the different parts of the hog, the bacon is almost all fat, while the ham is mostly protein. Butter is an important fat food, more than eighty per cent of it being pure fat. Many nuts also are composed largely of oil; for instance, the peanut is about forty per cent oil. The same is true of the almond and the walnut. On the other hand, the chestnut contains a large amount of starch as well as a considerable quantity of oil. So in eating nuts one gets, as a rule, a large quantity of oil.

What is the next most important class of food elements? Again judged by quantity alone, the fourth and last class of food elements consists

of what we call "mineral substances." When a food substance is burned, the ash that is left represents the mineral matter that the food contains. The quantity of ash present in food products varies greatly. Some foods contain as high as three or four per cent of ash, while others contain less than one per cent. This mineral matter consists of various substances, certain of them being important to nutrition. Among these are *phosphorus* and *lime*, which are used in the body to form a considerable part of the bones and the teeth. The other minerals play parts of greater or less importance. Thus we see that the mineral elements of food, although least in quantity, are quite as necessary for proper nutrition as the larger quantities of fat, protein, and starch which our food contains.

In a general way it may be said that for every one hundred pounds of food we eat, two pounds should be mineral substances. Among these phosphorus, sulphur, chlorine, lime, iron, magnesia, salt, soda, and potash are the most necessary.

Is there another food element besides the four classes described? An important element besides those we have been studying has recently been discovered in certain food products. This element has been given the name *vitamines*.

It is still uncertain of just what ingredients this element is composed, but it is known that vitamines are substances that are very active in aiding the process of digestion. They also greatly increase the nourishing value of other food elements with which they are found. Vitamines are thought to contain phosphorus and perhaps nitrogen and hydrogen, and are found principally in the bran of cereals, in milk, fruit, and vegetables. These foods, we have learned, already contain very valuable food elements, the vitamines increasing their nourishing value still more. It has been discovered that these foods should be eaten in a natural state, that is, with as little cooking or refining as possible, in order to get the most benefit from the vitamines they contain.

Are the acids which exist in foods of value in nutrition? The acids found in certain food products play an important part in nutrition. They are to be classed with the condiments, and thus become food products. The acids found in certain kinds of fruit are also very generally found in all vegetable substances, though only in small quantities.

In the sap of such sugar-producing plants as sugar cane, sugar beets, and sorghum, and in the sap of the maple tree, there are large quantities of acids. Most of these acids are the same

as the acid contained in apples, an acid which is called *malic* acid. Other vegetable acids are frequently found in sugar-producing plants of this kind but in small quantities only. *Citric* acid is found in lemons and oranges, and *tartaric* acid in grapes. All these acids are combined in the fruit with other substances, principally potash.

Cutting sugar cane

Because these acids improve the taste of the foods in which they are found, they are condiments. When digested they produce a certain amount of heat, and so have a food value as well as a condiment value. They also perform a useful service in carrying into the body the soda and potash with which they are combined. These acids are wholesome when eaten in the foods in the combination in which they naturally exist, but they would not be wholesome if extracted from the foods and used as pure acids.

QUESTIONS TO HELP THE PUPIL

1. What causes differences in the same kind of food grown in different localities? 2. What are the three most

common articles of food? 3. What is a universal food? 4. What is a fourth article of food that should be used more than it is? 5. What is the saying about an apple? 6. To what does the term food apply scientifically? 7. What is one of the four principal foods necessary to nutrition? 8. Which is more easily dissolved, sugar or starch? 9. Name the principal starch foods. 10. Are sugars and starches much alike? 11. By what common name are wheat, corn, barley, rye, rice, oats, and buckwheat known? 12. What general percentage of starch do cereals contain? 13. How much of the solid food in the potato is starch? 14. What other starch foods have you eaten? 15. In what forms do we eat sugar? 16. What food do you know that is rich in sugar? 17. What vegetable is particularly rich in sugar? 18. What is the result of eating much sugar? 19. What is obesity? 20. What sickness is indicated by the secretion of sugar from the body? 21. What is another important food element besides the carbohydrates? 22. Of what substances is protein made up? 23. What is the purest form of protein in nature? What foods are the principal sources of it? 24. What is the third food element? 25. Name some important fat foods. 26. What is the principal element in nuts? 27. What is the fourth important class of food elements? 28. Name some important mineral substances. 29. What should be the proportion of mineral substances in our food? 30. What important element has recently been discovered in foods? 31. What is the value of vitamines in digestion? 32. In what foods are vitamines principally found? 33. Of what value are the acids contained in foods? 34. With what class of food elements are acids to be classed? 35. Name the three classes of acids and several fruits containing them. 36. What is the value of these acids in nutrition?

37. Do the different tissues in our bodies require different kinds of nourishment? 38. What is scientific nutrition? 39. Are starch and sugar alike so far as digestion and nutrition are concerned?

V. A Study of the Elements of Food

How may we know where to find and how to use the four principal elements of nutrition? The answer to this question is of great practical value. If we wish to keep well and be as useful as possible we must not only know something of the nature of foods but, in order to secure the best results, we must know how to use them in a practical way. It would not be practicable for us to weigh and analyze each portion of food set before us. Fortunately, we do not need to do this, for nature varies little in her work. In the amount of food elements they contain she makes foods of the same kind practically alike from year to year. So we need only know the average composition of any staple food product to determine the correct proportion of that product that should be eaten

In order to be able to do this effectually we shall study some of the more important food products that are daily set before us. Every product contains, each in its own proportions, the elements of nutrition which we have noted.

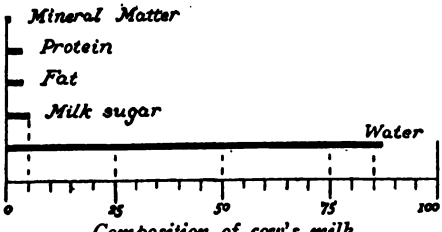
What is the average composition of milk? In our country the term "milk," when used without qualification, means milk of the cow. Cow's

milk has been analyzed thousands of times in this and other countries, so that we know with practical exactness its average composition. This is set down in the following table:

THE COMPOSITION OF COW'S MILK

WATER	MILK SUGAR (LACTOSE)	PROTEIN (CASEIN)	FAT (BUTTER)	MINERAL MATTERS
87 per cent	5 per cent	3.4 per cent	3.9 per cent	.7 per cent

One hundred pounds of milk furnish thirteen pounds of food in a dry state. These thirteen pounds of food contain the various food elements in the right proportions to furnish an ideal ration for the growing child, and especially for the infant. Attention is called to this fact for the reason that in its composition milk is a model for selecting the food of the child after he is weaned and he ceases to be nourished wholly by milk. If this be a true guide, and there seems to be no doubt of the fact, then in choosing food for the growing child we should see that it contains all the elements of growth in about the same proportion as they exist in the dry matter of milk. Then from the above table we may obtain the following



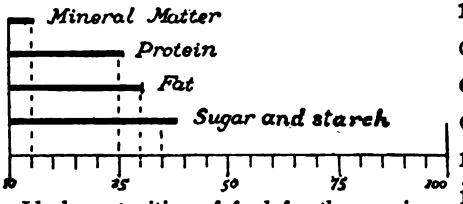
Composition of cow's milk

table of proportions of the food elements in milk, excluding the percentage of water

IDEAL COMPOSITION OF FOOD FOR THE GROWING CHILD IN PARTS OF 100 OF DRY MATTER

SUGAR AND STARCH	PROTEIN	FAT	MINERAL MATTER
38.46 per cent	26.16 per cent	30 per cent	5.38 per cent

There are traces of various other substances in cow's milk, but these are so small in quantity that they need not be considered here. In order to simplify the above table, and make it more easily remembered, we may say that when making up a diet for children that part of it other than milk should be in the following proportions: The protein should be five times the quantity of mineral matter; the fat six times the quantity of mineral matter; and the sugar and starch eight times the quantity of mineral matter. Representing the mineral matter by 1, we have the following series of numbers: 1, 5, 6, 8. These figures are easily memorized.



Ideal composition of food for the growing child

MINERAL MATTER	PROTEIN	FAT	SUGAR AND STARCH
1	5	6	8

They represent the food elements in the relative proportions in which they should be present in the food of the growing child.

Is there any food product which can take the place of milk for the growing child? Yes, there is a common food product which is almost as well adapted for the growing child as milk. This food we call cereal, and it is advisable to use it in connection with milk for children beyond the age of infancy. The typical cereals are wheat, Indian corn (maize), rye, barley, rice, oats, and buckwheat. But children especially should use a great deal of milk with cereals. Wheat is the best cereal, although it produces too much acid when eaten alone; milk corrects that fault.

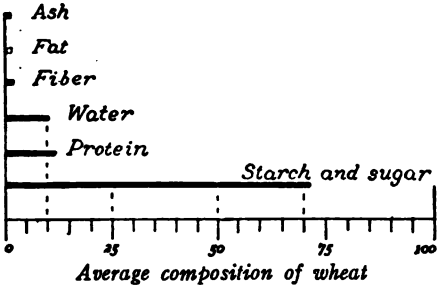
Milking the cow

What is the average composition of wheat? Wheat is rightly regarded as the most valuable of the cereals used for bread making, and its composition should be known to every one.

AVERAGE COMPOSITION OF WHEAT

	GRAMS[1]
Weight of 100 grains of wheat	3.8
	PER CENT
Moisture	10.50
Protein (gluten)	12.25
Fiber (indigestible)	2.40
Fat	1.75
Starch and sugar (principally starch)	71.35
Ash (mineral substances)	1.75

From this table we learn that wheat not only contains all the elements of nutrition necessary for the growth and sustenance of the body, but that these elements are present in the most suitable proportions. In fact, the elements in wheat, so far as they are digestible, exist in such proportions as to nourish all the tissues of the body as they should be nourished. But eating wheat alone is not advisable. It produces too much acid. If you will compare the composition of wheat with that of milk you will learn that wheat contains a much smaller quantity of fat and a much higher quantity of starch and sugar. The



Average composition of wheat

[1] The nickel, or five-cent piece, weighs exactly five grams. It takes about 150 kernels of wheat, 215 kernels of rice, or 170 kernels of oats to equal the weight of a nickel.

digestive organs of the infant are not suited to the digestion of starch. On the other hand, they are suited to the digestion of the fat which is in milk, and there is a comparatively larger quantity of that substance in milk. The growing child and the grown man can digest starch readily, and in the cereals nature provides a food product containing large quantities of starch. Therefore, after the period of infancy, cereals are well suited to the growing child.

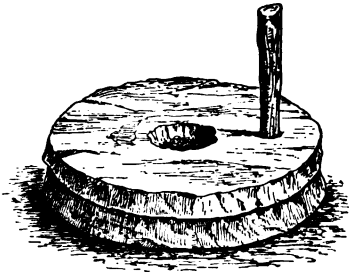
A wheat head

But it is well to remember that all wheat has not exactly the composition given in the table. Wheat recently harvested contains considerably more moisture than is given in the table. When wheat has been kept for a long time in a dry granary, and especially in a dry country, the amount of moisture is less than that given in the table. Thus whenever the amount of moisture in a grain of wheat decreases, the amount of all the other ingredients must be *greater* in comparison with the amount of moisture that is left. On the other hand, when the amount of moisture increases, the amount of all other ingredients must be *smaller* in proportion to the greater amount of moisture.

How is wheat best used for food? On account of its extreme hardness, and the smallness of the kernels, there is, as a rule, such difficulty in chewing the kernels that it has led to the preparation of wheat in forms more suitable for eating.

Old and new ways of grinding grain. In primitive times grain was crushed between stones by hand. The natives who inhabited this country at the time of its discovery by Columbus prepared their grain in this way. As civilization

Indian grinding stones



The quern. First form of grinding mill

advanced, better methods were needed. This led to the development of the quernstone or millstone. Millstones are made of hard, gritty stone so adjusted that one stone revolves against the other, crushing the grain between them.

In the modern roller mills, millstones are not used in grinding grain. In such mills, iron or porcelain rollers have taken their place, and from grain to finished product the material is not touched by hands.

Grades of flour. There are several grades of flour. The words "patent flour" are used to name the product of greatest whiteness and commercial value, while other names, such as Bakers' Flour, Family Flour, and Red Dog, are used for the lower grades. "Red Dog" is the name of a flour of low grade, that is, so far as color is concerned. Although it is not perfectly white, it contains a larger portion of important nourishing ingredients than does the white patent flour. In the process of milling, the germ of the wheat kernel and the hard fibrous covering of the kernel, called bran, are removed. These materials are then sold separately for cattle foods under the names of *bran* and *shorts* or *middlings*, and the various grades of flour, made from the inner part of the kernel, are sold for use by bakers and housewives.

Sometimes manufacturers add cornstarch to flour, because it is cheaper than wheat and makes the wheat go farther. This mixed flour is less nourishing than the pure wheat flour and should not be used by the housewife.

How does the milling process affect the nutritive value of wheat? The public taste demands a flour of extreme whiteness. To meet this demand the miller strives to make his flour as white as he possibly can. Since the advent of the steel mill he is able to produce a much whiter

flour than he could under the old system of grinding the grain between millstones. But the wheat germ, which is discarded in the process, contains a large quantity of phosphorus and oil, and this oil is a food of high value for producing muscular power and heat. The bran, which is also discarded, is particularly rich in lime, phosphorus, and potash, elements of much importance in the nourishment of the body. It is also rich in protein, but because of its hardness and the quantity of fiber it contains, the wheat bran cannot be completely digested by the human digestive organs. On the other hand, the presence of the bran, when ground fine with the flour, has a most excellent effect in securing a proper movement of the contents of the digestive organs.

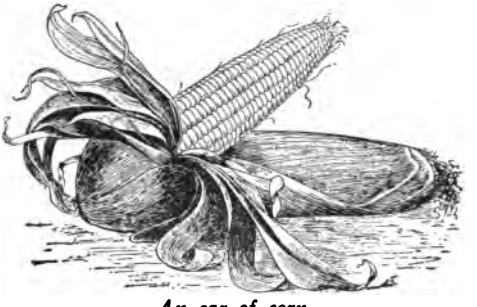
A great many of the world's best students of diet believe that whole-wheat flour — flour which contains the entire grain finely ground — is more wholesome and more nourishing than fine white flour. Other experts maintain that white flour is more completely digestible than whole-wheat flour, and for that reason should be preferred. But for growing children especially, the whole-wheat flour would seem greatly to be preferred to white flour. Whole-wheat flour provides the special nourishment needed for the bones and the teeth, a nourishment not to be found in white flour. If you

chickens are fed nothing but white flour they do not grow and flourish. If they are fed whole-wheat flour they grow rapidly and keep in excellent health. Even in the case of grown men and women, whose bones and teeth are already formed, bread made from whole-wheat flour is nourishing as well as palatable.

It is clear, then, that growing children should be fed on whole-wheat flour, or some other whole cereal, though hard-working men and women can occasionally, and even frequently, eat the products made from white flour without noticeable injury to health.

Can human beings live on wheat alone? Yes, it is possible to maintain life for a long time and apparently be well nourished, and yet eat nothing but wheat. But the human taste and the need for alkali — that is, soda and potash — demand a variety of foods in order to keep the digestive organs working to the best advantage of the body. In other words, we become tired of eating one thing only. We may like that one thing very well for a short time, but finally, if we have nothing else to eat, we grow tired of it. With the exception of milk, the food that we would be able to eat alone for the greatest length of time is probably wheat and its products. What is said of wheat to a certain extent may also be said of the other cereals.

Next to wheat, what is the most important cereal used as food for human beings? Judging from its use as a food in the United States, the most important cereal next to wheat is Indian corn or maize. Maize, or corn as it is commonly called in this country, is by far the largest cereal crop of the United States. For every bushel of wheat grown in the United States, about four bushels of corn are produced. Corn is used as food for human beings in all parts of the country, but the amount so used is probably considerably less than the amount of wheat used for the same purpose. Corn is used most extensively as food for hogs, horses, and cattle. Practically all the hogs raised here are fattened on corn.



An ear of corn

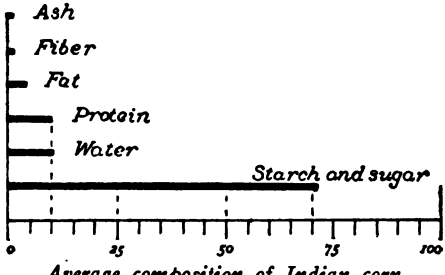
Indian corn is not very extensively used as food for human beings in other parts of the world. But in the Balkan States and Italy in the southern part of Europe where corn is grown, its use is increasing. Indian corn is so called because it was first found commonly cultivated by the Indians in North and South

America at the time of the discovery of the new world.

THE AVERAGE COMPOSITION OF INDIAN CORN

	GRAMS
Weight of 100 grains of corn	38.00
	PER CENT
Moisture	10.75
Protein	10.00
Fiber (indigestible)	1.75
Fat (oil)	4.25
Starch and sugar	71.75
Ash (mineral substances)	1.50

What are the chief differences between Indian corn and wheat? Though the elements that make up corn are apparently the same as those that go to make up wheat, there is much difference both in the quantity and in the character of these elements in the two cereals. As far as moisture is concerned, wheat and corn are almost alike. But corn contains much less protein than wheat. The average proportions are ten per cent in corn and about twelve per cent in wheat. There is also a great difference in the protein itself. The wheat protein consists largely of those



Average composition of Indian corn

elements which, when mixed with water, unite to form what is known as the *gluten* of wheat. This gluten makes it possible to knead wheat flour into a loaf that will hold together and at the same time be somewhat elastic. The protein of Indian corn does not have this elastic quality. It contains practically none of the substance known as gluten. The principal protein of Indian corn is known as *zein*. Another striking difference between Indian corn and wheat is that Indian corn contains much more oil than is found in wheat.

Thus it is seen that while Indian corn is highly nutritious, it is distinctly different from wheat in its composition. It is much less valuable than wheat as a food for young people or young animals. Experience has shown that if pigs be weaned when quite young, so that they get no milk, and are then fed exclusively on Indian corn, they fail to grow; they lose flesh, their hair drops off, and finally many of them die. This is not the case with pigs that are fed on whole wheat. It has been found that the chief trouble is in the zein. While zein has a high value as a nutritious element for grown people, especially when mixed with other forms of protein matter, it does not promote growth. But if milk is used with the corn, then the zein becomes very valuable as a

food. Thus if children are given Indian-corn products to eat, such products should always be served with milk. On a diet of mush and milk children thrive.

If Indian corn, therefore, were the only article of food we could get, we should not be nearly so well nourished as if wheat were our only article of food.

What is corn meal? Corn meal is the term applied to finely ground Indian corn. But the particles of corn meal are much larger than the particles of white wheat flour. It was a very common practice, until within the last few years, to grind the entire grain to make whole corn meal. Thus the outer envelope of the grain, and the germ, which is so rich in phosphorus and oil, were retained in the meal, making it more nutritious than if these elements had been removed.

But it has been found difficult to transport and keep whole corn meal for any length of time, because it molds quickly when moist and soon becomes rancid because of the large amount of fat it contains. The term "rancid" is applied to the sharp, bitter, disagreeable taste of an oil which has partially spoiled. For this reason during the last few years millers have been grinding corn in the same way that they grind wheat flour. They take off the outer

hull and remove the germ, thus making a corn meal which has much better keeping qualities but less valuable nutritive properties than the whole corn meal. In order to keep corn meal fresh for transportation it is dried.

The best corn meal, so far as nutrition is concerned, is the freshly ground meal made from the whole corn grain.

What are the relations of Indian corn to health? In many parts of Europe people think that Indian corn is not a fit food for human beings. We have already learned that corn meal very easily molds when moist, or becomes rancid because of the large percentage of fat it contains. In this condition corn meal has sometimes been found to be poisonous. Some people have claimed also that the skin disease called *pellagra*, which has now secured a foothold in our country, is caused by eating musty corn meal. However, all evidence goes to prove that Indian corn meal does not cause pellagra, but that the disease is due to poor nutrition, perhaps to living almost entirely on carbohydrate food.

From the above it is clear that in its relation to health Indian corn has not quite so good a record as wheat. But when corn is ground whole in order to retain all the elements of the grain, and is kept in a proper way, its value as

a food product is high, especially when eaten with milk, or other protein substances such as egg, lean meat, or peas and beans. In this case it does not in any way tend to injure health or induce disease. A more general use of Indian corn as food for human beings can therefore be highly recommended.

In what forms is Indian corn eaten? Many food preparations can be made from Indian corn. The simplest of all is "mush," or "hasty pudding." Corn meal is also used for making bread. In a large part of our country, especially in the South, bread made of corn is a staple food. Corn is also made into hominy, and into many varieties of breakfast foods. Indian corn can thus be prepared in very many forms as food for human beings, and when served in a properly balanced ration all forms are wholesome and nutritious.

A rye head

Is rye ever used as food for human beings? Only an American would ask that question. In Germany, Russia, and other parts of Europe, rye is used very extensively as food for human beings. In many places rye bread is much more common than wheat bread. Rye is nourishing and wholesome, and may be

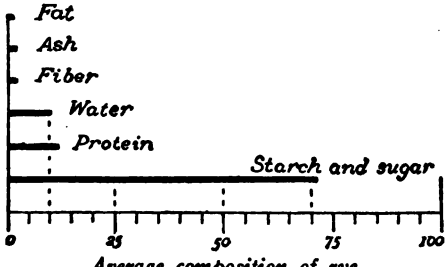
used to advantage alternately with white bread. Usually rye is cheaper than wheat, and for that reason there is generally some economy in using it for bread making.

How does the composition of rye differ from that of wheat and corn? Rye has about the same percentage of protein as wheat, but a much smaller content of fat or oil than corn.

THE AVERAGE COMPOSITION OF RYE

	GRAMS
Weight of 100 kernels of rye	2.5
	PER CENT
Moisture	10.50
Protein	12.00
Fiber (indigestible)	2.35
Fat (oil)	1.50
Starch and sugar	71.75
Ash (mineral substances)	1.90

Since rye contains less gluten than wheat, and more than Indian corn, rye bread usually crumbles more easily than white bread, but holds together better than corn bread. In making rye bread it is advisable to mix some wheat flour with the rye so as to form a more elastic and more porous loaf.



Average composition of rye

Rye is not grown extensively in the United

States. While the average area on which rye is grown is two million acres and the average area devoted to wheat is over forty million acres, more than one hundred million acres are devoted to corn.

Barley head

Is barley used as a food for human beings? Barley is another cereal that is used to some extent as food for human beings. But its use for this purpose is comparatively small. On the other hand, it is grown somewhat extensively in the United States for cattle food and for making beer.

Barley that has sprouted is called *malt*. This sprouted barley or malt has, above all other cereals, the property of converting the starch it contains into a kind of sugar, or maltose, resembling cane sugar but, in many particulars, distinctly different from it. Malt makes a good food for human beings, and is used by many, especially those whose digestive organs are not in good condition. Many persons who have diseased stomachs are unable to digest starchy substances, but they can very readily take care of starch which is already partly digested as in the maltose of the sprouted barley. Very

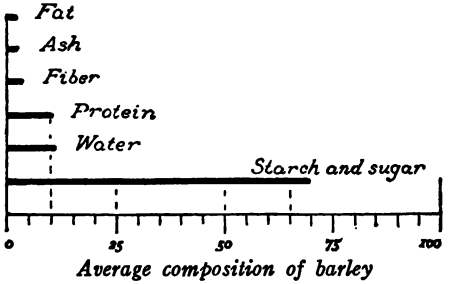
little barley is used directly as food in this country. It is sometimes served in soups or mixed, finely ground, with infants' foods.

What is the average composition of barley? Barley very closely resembles the other cereals in its composition, but also its protein matter differs in character from that of the others.

THE AVERAGE COMPOSITION OF BARLEY

	GRAMS
Weight of 100 grains of barley	4.5
	PER CENT
Moisture	11.00
Protein	10.85
Fiber (indigestible)	3.85
Fat (oil)	2.25
Starch and sugar	69.55
Ash (mineral substances)	2.50

If we compare these figures with those for the composition of the other cereals it is seen that the amount of protein in barley is greater than that in Indian corn and less than that in wheat. It contains more fat, or oil, than wheat or rye, but less than Indian corn. It also has a larger content of mineral substances (ash) than wheat. Bread made of barley flour crumbles very easily, and



Average composition of barley

for that reason it more nearly resembles corn bread than wheat bread.

Carolina rice

What is the value of rice as a food? Next to wheat and Indian corn, rice is the most valuable food product among the cereals. It is used extensively by the Oriental or Eastern nations, especially Japan and China. Rice is not widely cultivated in this country, the average area in rice in the United States being less than a million acres.

Rice, unlike other cereals, is usually grown under water. After it is planted and has begun to grow, water is turned on the fields and kept there until near harvest time. Other cereals would be killed by such treatment. A few varieties of rice grow in dry soil like other cereals, but they are not so highly regarded for food purposes. Rice, therefore, is grown to best advantage in lowlands which can be flooded easily, or in regions where abundant water is available for irrigation purposes.

How does rice differ from the other cereals? Rice differs from the other cereals chiefly in its high content of starch and its low content of protein. In its food value rice resembles the potato more closely than it does wheat.

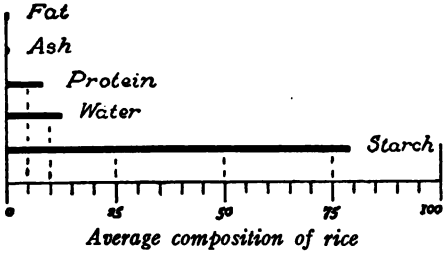
THE AVERAGE COMPOSITION OF RICE

	GRAMS
Weight of 100 grains of polished rice	2.25
	PER CENT
Moisture	12.30
Protein	8.00
Fat (oil)	0.30
Starch	79.00
Ash (mineral substances)	0.40

These figures show that rice has a low protein content, a low fat content, and a low mineral content. It is essentially a starch food.

How is rice prepared for eating? Rice is usually prepared for eating without being ground. There is such a thing as rice flour, but not a great deal of it is used for food. The grains of rice, which resemble wheat grains in form, are cooked whole.

It has been a very common practice to submit the rice grains to a process of rubbing, by means of which the external coating, the rice bran, is removed without crushing the grain. Then, in order to make the grain still smoother and more shiny in appearance, it has been customary to coat it with finely powdered talcum, using a



Average composition of rice

little sugar or glucose to make it stick. These practices are wrong because the consumer is deceived by the appearance of the grain, and especially because of the injurious effect of such rice on the consumer's health. It has been found that people who live almost exclusively on rice treated in this way develop a disease of the digestive organs in some respects resembling anæmia (poor blood). This disease, known as *beri-beri*, often proves fatal. But it has been found that when unpolished rice is eaten, beri-beri never occurs. Also, if the rice bran that is rubbed off in polishing is given to those who have the disease, they recover.

A bunch of oats

It is difficult to get unpolished rice in the United States. It is not so white nor so good to look at as the polished, but it is far more pleasing to the taste, more nutritious, and more healthful.

Are oats used as food for human beings? In Scotland particularly, and in the United States, oats are largely used as food for human beings. When the oats, after the removal of the chaff, are crushed or ground, the product is called oatmeal, and oatmeal is much used for so-called breakfast foods; that is, for making the porridge or mush to be eaten with milk or cream, particularly at the morning meal. Large quantities of oat products prepared in this way are sold in all the markets of the United States. There is more gluten in oats than in Indian corn, but not nearly so much as in wheat.

In the United States oats are used principally for feeding horses. The acreage planted in oats is very large, amounting to almost thirty-five million acres every year.

What is the food value of oats? One hundred grains of oats with the chaff on, this being the condition in which oats are always sold, weigh about three grams.

THE AVERAGE COMPOSITION OF OATS (unhulled)

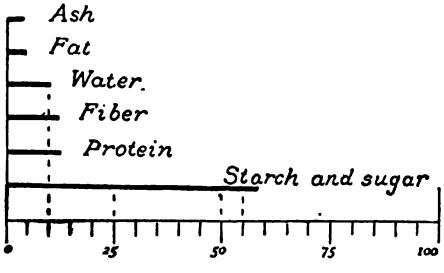
	PER CENT
Moisture	10.06
Protein	12.15
Fiber (indigestible)	12.07
Fat (oil)	4.33
Starch and sugar	57.93
Ash (mineral substances)	3.46

When oats are prepared for food to be used by human beings the chaff or outer hull is removed.

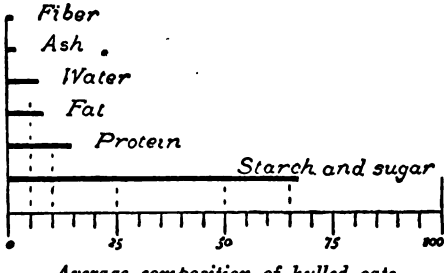
THE AVERAGE COMPOSITION OF OATS (hulled)

	PER CENT
Moisture	7.00
Protein	14.38
Fiber (indigestible)	1.38
Fat (oil)	6.00
Starch and sugar	69.10
Ash (mineral substances)	2.14

If you compare the composition of the hulled oats with the composition of the unhulled oats you will see that the removal of the chaff has increased very much the percentage of fat and of protein, while it has diminished to a great extent the quantity of indigestible fiber. This is highly important from the point of view of food for human beings. While horses and cattle can eat unhulled oats, because they are able to digest the chaff, it would be difficult for the human stomach to make use of the unhulled oats.



Average composition of unhulled oats



Average composition of hulled oats

It is also evident that the hulled oats differ from other cereals we have studied in the larger amount of protein they contain, and especially in the amount of fat. Hulled oats are to a certain degree similar to nuts in the quantity of fat or oil they contain, though the quantity is much smaller than that contained in nuts.

Oatmeal is regarded as a wholesome, nourishing food. It is especially valuable for those who work hard with their hands, as the oil in the oats furnishes a large amount of heat and energy. The large quantity of protein which is provided takes the place of the protein tissues which have been used up during hard labor. It also furnishes heat and energy. Hulled oats can therefore be recommended as a very important human food product.

VITAMINES

What are vitamines? By "vitamine" we mean certain life-giving elements recently discovered in our foods. It has long been known that certain foods seem to do more good than could be expected from the amount of nutriment they contain. Such foods were known to be more wholesome or healthful than others of apparently the same nutritive value. For instance, a certain quantity of protein fed to a

Japanese girls transplanting rice in a rice field

cow in the form of bran produced more milk than the same quantity of protein when fed in the form of cotton-seed meal. Bran thus became a common food in the dairy. It is now known that bran is very rich in the elements known as vitamines.

How was this discovery made? When the Japanese adopted the American habit of using polished rice (page 47) a new disease arose among the people. They called it beri-beri. It was a disease of the digestive organs and

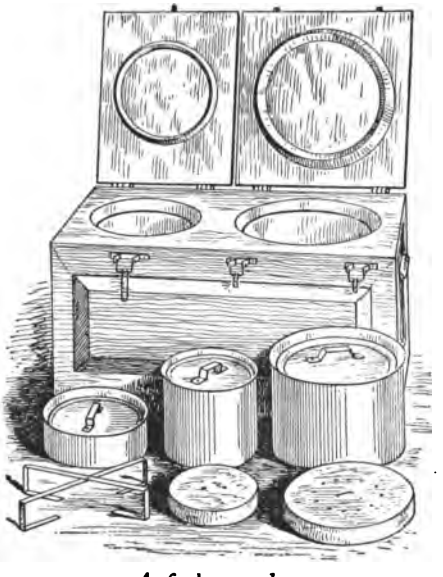
many died from it. By accident a patient dying of beri-beri was given a gruel made of rice bran. He recovered. This led to the discovery that eating polished rice was the cause of beri-beri.

To what did this discovery lead? It led to a study of the bran of other cereals and of the vital principles of other foods. It was soon found that the bran of all cereals had properties in relation to health similar to those of rice bran. Other foods also, such as fresh milk, were found to have these qualities. The life-giving vitamines in milk were found to reside particularly in the fat. Cream and butter therefore have more vitamines bulk for bulk than milk. Fruits, vegetables, and probably meats, also contain them. But the article which thus far is known to hold the largest quantity of vitamines is yeast.

What is the meaning of the word "vitamine"? The word "vitamine" is derived from the chemical term *amine*. This term is applied to a compound containing one nitrogen and two hydrogen atoms, which is almost the same combination as in ammonia. *Vita* is the Latin word meaning "life." So the term "vitamine" denotes a body resembling an amine which has intimate relations to life. But the chemical constitution of the so-called vitamine has not yet been

definitely determined. It is now thought to contain phosphorus, and it may contain nitrogen and hydrogen also but not in the form of an amine. So until more is known about them it is best to regard these bodies as activators, or substances that are active in aiding the process of digestion and nutrition.

What effect has heat on vitamines? A high temperature continued for a long time kills some of these bodies. Moderately high temperatures for short periods diminish their activities. It is far better to use a fireless cooker than to keep the food boiling over a flame for an hour or more. The temperature of the cooker is applied longer but it is not so high as the temperature reached over the fire. It has long



A fireless cooker

been known that boiled milk is less wholesome than fresh milk. Now we know that this is because the vitamines have been injured by long continued high temperature in boiling.

What effect have chemicals on the vitamines? Mild acids, such as fruit acids, do not injure and probably favor the activity of the vitamines. On the other hand some alkaline bodies, bicarbonate of soda in particular, affect them injuriously. For this reason we should avoid adding alkaline substances in cooking our food.

How has it been proved that vitamines can be separated from the foods containing them? If chickens are fed on polished rice or white flour they soon develop a disease resembling in some respects beri-beri. They gradually become paralyzed and die. But if fed on water extract of bran while they are very sick, they do not die. They get well. They will also recover if yeast is fed to them. If we now mix bran gruel or yeast extract with fuller's earth, filter the mixture to secure the liquid bran or yeast extract, and then feed this liquid to the sick chickens, we find that it does them no good; they die. On the other hand, if the fuller's earth left in the filtering vessel be fed to the chickens they get well. This shows that the vitamines have all been taken out of the bran gruel or yeast extracts by the fuller's earth.

Is there more than one kind of vitamine? There are at least two classes of vitamines, one soluble in fat or oil and the other in water. Neither the water-soluble nor the fat-soluble vitamines will promote growth when alone. Both must be present. Thus there are new reasons for the emphasis which has been placed on the importance of always using milk with cereals. The cereals contain the water-soluble vitamines, and the milk, the fat-soluble vitamines. Other animal fats may contain the fat-soluble vitamine but none of them to the extent in which it is found in butter.

Some vegetable oils also contain the fat-soluble vitamine in small proportions. Alfalfa and cabbage leaves are quite rich in it.

What are the health lessons of these facts? We learn from the discovery of vitamines the importance of eating natural foods such as whole wheat and other whole cereals, fresh milk, fruits, vegetables, and rare-cooked meats. Not only are these food products valuable for the lime, phosphoric acid, and other minerals they contain, but also for the life-giving properties (vitamine activators) they contain. We also learn that cooking should be conducted at a low temperature and not carried to extremes. The rare-cooked foods are the most wholesome. We learn especially that the over-refining of

foods in their preparation, such as bolting the wheat and peeling the potatoes, threatens the health, happiness, and welfare of our people.

QUESTIONS TO HELP THE PUPIL

1. Why is it important to know the average composition of a staple food? 2. Why is milk an ideal ration for the growing child? 3. What is an ideal or well-balanced ration? 4. What simple figures represent the ideal proportion of food elements for a growing child as represented by milk? 5. What cereal has these elements in almost the right proportion? 6. What is the objection to wheat when eaten alone? 7. What is the average composition of wheat? 8. What food element is present in wheat in smaller quantities than in milk? 9. What element is present in greater quantities? 10. How is wheat prepared for food? 11. Describe old ways of grinding grain; the new way. 12. What is "patent flour"? 13. What part of the wheat kernel is removed in modern grinding processes? Why should the germ and the fibrous covering not be removed? 14. Why should cornstarch not be mixed with flour? 15. What is whole-wheat flour? 16. What special nourishment does whole-wheat flour provide? 17. For what is corn used most extensively in the United States? Is it also much used as food for human beings? 18. What are the chief differences in the makeup of corn and wheat? 19. Is zein of corn as nutritious as gluten of wheat? 20. What is good to mix with corn? 21. What is the best corn meal? 22. Where is rye commonly used as food for human beings? 23. For what is barley used most extensively? 24. How is rice grown? 25. What is the chief food element in it? 26. In preparing rice for the market what bad practice is followed? 27. For what persons is oatmeal particularly good? 28. What is a vitamine? 29. What effect has heat on a vitamine? 30. What effect has bicarbonate of soda on a vitamine? 31. What foods contain the most vitamines?

VI. The Preparation of Bread Foods

What is bread? By bread we usually mean a cereal, ground whole or bolted, which has been mixed with water or milk in such a way as to form a paste or dough. Yeast or baking powder is then usually added; after which the dough is molded or rolled into any convenient form and baked on a stone or in an oven until the crust is brown. The single word "bread," when used in the United States, generally means bread made of wheat. The term "loaf" applied to bread means a portion of the dough formed as described above, after it has been molded into some convenient shape and baked.

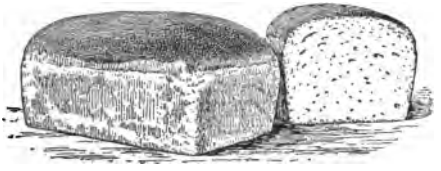
The seed of the cotton plant yields a large amount of yellow oil

What is shortening? The term "shortening" is applied to a fat or oil which is mixed with flour when a bread dough is made, for the purpose of making the bread more brittle and more easily broken after

baking. In addition to this the outside of the loaf or the inside of the pan is often greased with a fat or oil, so that after the bread is baked it will not stick to the pan. Nearly all bread has a little shortening added to it.

One of the most common kinds of shortening in general use is lard. Butter also makes an excellent shortening material, and is used particularly in the making of cakes. Vegetable oils are used to a large extent for the same purpose, especially cotton seed oil and olive oil.

Wheat bread is an article of food used at almost every table. There is scarcely a single meal served in the United States at which bread of some description is not eaten.



Wheat bread

What other cereals besides wheat are used for bread? All the cereals can be used for bread making. Indian corn is used extensively for that purpose, especially in the United States. Most of the bread made from Indian corn is eaten hot. There is also a bread made of corn meal called "pone." The corn pone was a staple article of diet among the early settlers in our country. It is a wholesome and excellent kind of bread and deserves to be widely used,

though at present it is rarely made except in the homes of those who live near the frontier or in the South.

Rye is used extensively for bread making in foreign countries, but not to a great extent in the United States. In many parts of Europe, especially in Germany and Russia, rye is more commonly used for bread than wheat. Rye flour does not make so white a bread as wheat flour, but the bread is pleasing to the taste and nourishing and can be used now and then in place of white bread. Barley, rice, and oats are not used to any extent for bread making in the United States.

What are griddle cakes? Griddle or hot cakes are a variety of bread made from a batter much softer than that used for making bread. They are baked quickly on a very hot, smooth surface. As soon as one side of the cake is

A modern kitchen. Making bread in the home

A maple orchard in sugar-making time

brown it is turned and baked on the other side. It is customary to make griddle cakes of buckwheat flour or corn meal, although white wheat flour makes a very good cake, more tough and elastic than that made from the other cereals.

The griddle cake is served regularly at breakfast in many homes in the United States. It is usually eaten with sirup made either from the sap of the maple tree or from sugar cane or sorghum. Manufactured sirups are made largely of a sirupy substance called glucose, which is produced from the starch of Indian corn or of the potato by chemical treatment. Maple sirup is made in large quantities in New England, New York, and Ohio. Formerly much of it was adulterated, and even now much

larger quantities of so-salled maple sirup are sold than are made of the maple sap. It is a common practice among manufacturers to mix a little maple sirup with a large quantity of some other kind of sirup so as to give the entire mixture a maple flavor. Before the Food and Drugs Act became a law these mixtures were sold as pure maple sirup. Molasses, which is the sirup obtained from sugar in the process of manufacture, is also highly prized for eating with hot cakes.

Many food experts object to the use of hot cakes for food, claiming that in this condition the flour or meal used is not so digestible as when made into bread. One of the principal objections to hot cakes is that they taste so good we eat too many of them.

Another form of bread is known as cake. By the term "cake" is meant some cereal product, usually wheat flour, to which considerable quantities of sugar, egg, and butter have been added, and also usually some flavoring substances. There are many varieties of cake, with which most of you are already quite familiar.

Is it advisable from the health point of view to eat cake? When the cake is made out of wholesome materials—good flour, good butter, and good eggs—its wholesomeness is assured. U[illegible]ly, cake is usually not a part of the

dinner itself, but is served after the dinner as dessert. By the time dessert appears the ordinary person usually will have eaten all that he should eat. The appetizing character of cake, its appeal to the sense of taste, and, when well made, its general excellent qualities make it extremely tempting. We are therefore inclined to put into our stomachs large quantities of this very nourishing material after we have already taken all the nourishment we need. For this reason cake becomes a menace to health, not because of what it is made of or the way it is made, but because of the circumstances under which it is eaten.

Cake contains many nourishing materials. Besides the flour, the egg content especially is a high-grade nourishing ingredient in cake. The butter and the sugar in cake are well suited to the development of heat and energy. So, if people eat much cake, they should take liberal exercise or engage in hard manual labor. It is best for a person of quiet habits who takes little exercise and does not work hard to let cake alone.

Is cake good for growing children? No, cake is not good for children. While it is nourishing and valuable as a food, it does not provide the food elements in the proportion that is best for the child. In cake the heat-forming and

energy-forming elements are far more abundant than they should be in a well-balanced ration for growing children. Unfortunately, cake is one of the things which the child learns to desire more than most other foods, and when the taste for it is once formed it is difficult to overcome. It is far better to prevent the child from forming a habit than to try to control it when once formed. Children should not be permitted to eat cakes, candies, or artificial sweets. Natural sirups and jams and jellies made from sound fruits are the only sweets they should eat, and these only in small quantities.

QUESTIONS TO HELP THE PUPIL

1. What flour is generally used in the United States to make bread? 2. Give a definition of bread. 3. What is a "loaf"? 4. What is the purpose of mixing oil or fat with the flour? 5. What is this fat or oil called? 6. Why is the inside of the bread pan greased? 7. What vegetable oils are commonly used for shortening? 8. What is corn pone? Where is it much used? 9. What other cereals are used for making bread? 10. What is usually served with griddle cakes? 11. What law stopped the selling of adulterated sirups as pure maple sirup? 12. Why are griddle cakes or hot cakes sometimes injurious? 13. What is the difference between cake and bread? 14. When does eating cake become injurious?

VII. Vegetables and Fruits

What are vegetables? In its widest meaning the term "vegetable" includes all the products of plant growth. So "vegetable," in its broadest sense, is a term used to distinguish plant products from animal products. Both vegetables and animals, however, are living organisms, and there is probably no sharp line of distinction to be drawn between them. The vegetable sometimes seems to merge into the animal, or the animal into the vegetable.

But we have, on the whole, a very distinct impression of the difference between a vegetable and an animal. A growing vegetable is nearly always fixed in its location. That is, it cannot move itself from place to place. It cannot go out and seek its food; its food must come to it. This mode of life is so different from that of the animal that we learn to distinguish between the two in our earliest years of observation. The child of very tender years will be able to distinguish between the mouse that runs over the floor and the plant that grows in a pot or in the yard.

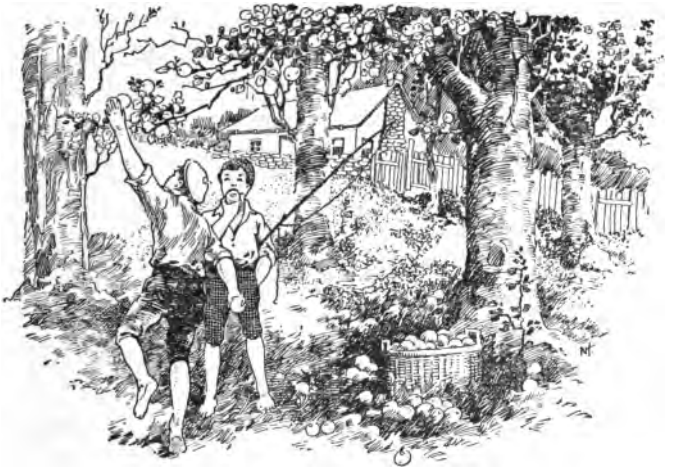
In a food sense the term vegetable is applied to a certain kind of food produced generally in the garden, the composition of which is

characterized by a large percentage of water. The vegetables which contain the largest amount of water are called *succulent*, meaning full of juice. Among these are the turnip, the radish, the carrot, the beet, cabbage, and spinach. Vegetables with less water, though still holding a considerable quantity, are the white potato and the sweet potato. Thus we make a marked distinction between the vegetable and the cereal, though they both belong to the vegetable kingdom. In like manner we distinguish between the vegetable and the fruit.

What is fruit? The term "fruit" when applied to food refers principally to the products of certain trees, small shrubs or bushes, and vines. The principal fruits used as food are apples, oranges, grape fruit, lemons, peaches,

vegetables at home. A thrifty, well-planned garden

pears, and cherries among the larger fruits that grow on trees, and blackberries, strawberries, raspberries, grapes, blueberries, and currants



Children gathering and eating apples

among the smaller fruits that grow on bushes and vines. The distinguishing characteristics of fruits are, first of all, their *acidity* (containing acid) and their sweetness. The sugars and acids in fruits seem to vie with each other to see which will win the upper hand. Sometimes the sugar is greatly in excess, as in the very sweet apple, and sometimes the acids, as in the cranberry. In general the best fruits, judged from their taste alone, are those in which the sweet and sour are about equal.

Fruits are not only pleasant to the taste but extremely valuable in maintaining good health. When it is possible to secure them, fresh fruits should be eaten every day, not only to improve the meal but as a safeguard to health. Nevertheless fruits are quite unsuitable for infants, and very young children should eat them sparingly. The child of five years and over may begin to eat fruits in greater abundance.

The food value of fruits lies chiefly in the sugar they contain. There are also valuable ingredients in them which minister to the mineral needs of the body. All fruits contain a little protein, but as a rule, except in the case of olives, very little oil or fat.

How much sugar do fruits contain? The quantity of sugar in fruits varies with the nature of the fruit and the degree of ripeness. In ripe fruits the quantity of sugar varies from three or four per cent to as high as fifteen or twenty per cent. Very ripe grapes contain a high percentage of sugar. The small fruits, such as berries, contain a low percentage of sugar, while apples, peaches, and pears have a medium quantity, varying usually from six to twelve per cent.

What kinds of acids exist in fruits? The different varieties of fruits contain different kinds of acids. The principal acids in fruits are as

follows: *malic* acid, which gets its name from *malum*, the Latin word for apple, and which exists in apples, pears, peaches, plums, cherries, and many other fruits; *citric* acid, which exists as the principal acid in the citrous fruits, oranges, lemons, and grape fruit, and is so called from the family name of these fruits; and *tartaric* acid, so called from the common word "tartar," a term applied to the compound of that acid with potash as it exists in grapes. Tartaric acid is found particularly in grapes of all kinds though it is also present in other fruits.

Traces of various acids are present in many of the fruit products, and it must not be thought that only one kind of acid exists in any one fruit. Apples, and other fruits of the same class, may have traces of other acids besides malic. This is also true of oranges and lemons as far as citric acid is concerned, and of grapes as regards tartaric acid. The acids in fruits are generally combined with other substances, such as soda, potash, or lime. In most cases the acids are combined with potash.

Should fruits be eaten raw or cooked? As a general rule it is best to eat fruits raw. There are of course certain dangers connected with eating raw fruits which must not be forgotten. Raw fruits may contain insects or so-called germs that are very dangerous. These evils

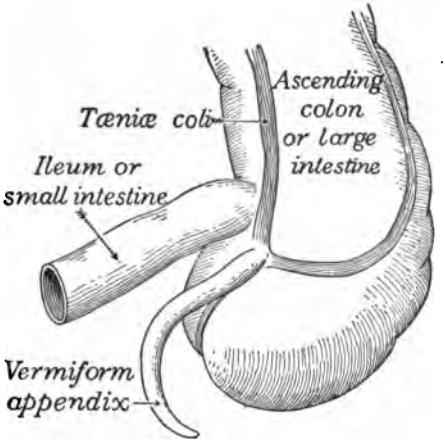
can be removed by careful cooking. Many fruits, also, are difficult to chew, as for instance certain hard kinds of apples. Cooking improves them in this respect, making them more edible (eatable), and more easily digested.

No hard-and-fast rule, however, can be given. Perhaps it is best to say that fruits should not always be eaten raw, nor should they always be eaten cooked. The judicious housewife will know whether a fruit should be cooked or not. Some fruits are never cooked, as, for instance, citrous products (orange, lemon, and grape fruit).

Are the small seeds of fruits injurious? A great many of the fruits, such as berries and grapes, have very small seeds. In the case of berries, such as strawberries and blackberries, to try to take the seeds out would be a hopeless task. They may be removed by cooking the fruit and then straining the pulp through a fine sieve, but they cannot be removed with any success when one is eating the fruit raw. There are some varieties of grapes in which the seeds are few in number. These seeds are also larger than the seeds in berries, and may be readily removed. By eating one grape at a time the pulp may be separated from the seeds in the mouth and the seeds rejected.

Some persons fear to eat small fruits, and

especially to give them to children, because of the presence of these seeds. It is said, and perhaps with some reason, that the seeds may lodge in the appendix and cause that very common and much dreaded disease, *appendicitis*. But on the whole, these fears may be regarded as entirely groundless. While the seeds of fruits may in some cases have been found in the appendix when it has been removed, they can hardly be regarded as the real cause of the trouble.



The appendix

In general we may say that the seeds of small fruits will be sent out from the body without doing any harm. Larger seeds, such as those of the apple and the melon, are objectionable, but these are not usually swallowed.

While it cannot be said that to swallow the seeds is *absolutely* without danger, yet the chance of harm is so small that we should not for that reason refuse to eat these fruits. In

the same way, play might be regarded as dangerous. Boys and girls are often hurt, sometimes seriously, sometimes fatally, at play. But that is no reason for forbidding children to play. The most wholesome of our foods are sometimes injurious, either because of an oversensibility of our system to their effects or because of our eating too much at one time. And yet no one would think of excluding such foods from our tables. In short, with watchfulness and care we may eat all kinds of fruit without any bad results.

QUESTIONS TO HELP THE PUPIL

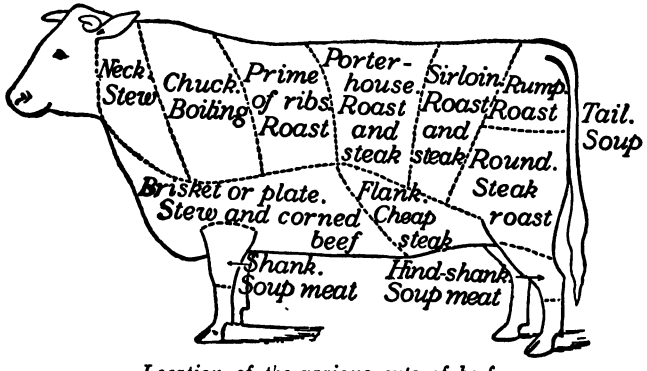
1. May any plant be termed a vegetable? 2. What is the distinction between a vegetable and an animal? 3. What is the term applied to vegetables containing much water? Name some. 4. Do cereals belong to the vegetable kingdom? Are they thought of as vegetables? 5. How many fruits can you name that are used as food? 6. What fruits grow on bushes? 7. Name some fruits that grow on vines. 8. What is the proportion of sweetness and acidity in the best fruits? 9. Name a fruit in which the acidity is far greater than the sweetness. 10. How old should a child be before eating fruit in any quantity? 11. What is the danger of eating raw fruits? 12. When does a fruit contain the largest quantity of sugar? 13. Name a fruit with a high content of sugar. 14. What percentage of sugar do apples, peaches, and pears contain? 15. What are the three principal kinds of acid in fruits? 16. Name five fruits containing malic acid, three containing citric acid, and one containing tartaric acid. 17. Do fruits contain one particular kind of acid only? 18. Is there much danger in swallowing small seeds? 19. Should large seeds be swallowed?

VIII. Animal Foods: Flesh, Fish, Fowl, Milk, and Eggs

What are the animal foods? Meat, the flesh of animals, or rather, the edible portions of animals, is the principal animal food. Milk and eggs must also be regarded as animal foods. Milk is the natural food of the infant and one of the necessary foods for growing children. Even grown people, who no longer need to take their food in the form of milk, may still get considerable benefit from drinking milk. Milk is one of the indispensable foods for invalids. There are many kinds of illness in which the patient cannot eat ordinary foods. But that patient is in a very hopeless state indeed who is no longer able to get some nourishment from milk. Thus we see that from the very beginning of life milk, an animal food, is a natural food for man.

The structure of the teeth and the digestive organs of man also lead to a belief that throughout life he is, to a considerable extent, adapted by nature to be a consumer of animal foods. Thus from every point of view meat and other animal foods in proper quantities and at proper times may be regarded as a normal though not indispensable food for man.

What is meant by meat? Meat is the edible portion of the bodies of animals. The term



Location of the various cuts of beef

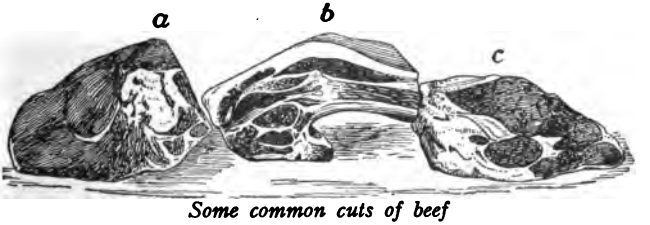
meat, therefore, includes not only the lean and the fat meats of the animal but also the nerves, the tendons, and the brain, and all the vital organs that are suitable for food. Nearly all parts of the body of the meat-producing animal are edible. Blood is used extensively as food, especially in Europe, where it is used in making what is called blood sausage. The skin, the bones, the intestines, and the lungs, however, are rarely eaten. The bones are not generally used as food, simply because of man's inability to chew them.

The term meat, however, as commonly used, refers only to the muscular parts of the animal.

At what age should we begin to eat meat? There are many different opinions concerning

the age at which children should begin to eat meat. To give children a little meat while they are still infants is a common practice, and it is not unusual to begin feeding children of about eighteen months small quantities of meat. This is a very unwise thing to do. The digestive system of the child, especially the very young child, is not well fitted for the digestion of meat.

While there is not much danger in giving a two- to five-year-old child a small bit of meat once in a while, he can get along very well without it. On the whole we may say that children under the age of five years should eat very little meat of any kind and, better, none at all. Between the ages of five and eight years, small quantities of the meat of healthy, recently killed animals, especially fowls, may be given without injury. But cured meats, and meats that have been kept in cold storage, should not



Some common cuts of beef
a, round roast; *b*, rib roast; *c*, loin roast

be given to children under ten years of age, and very little after that age.

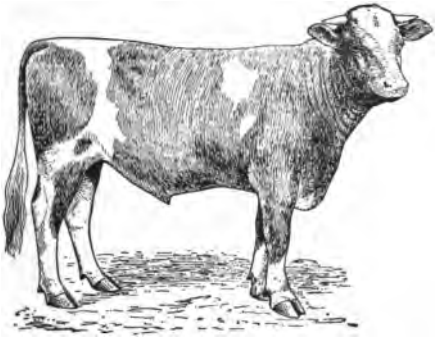
Meats are digested partly in the stomach. But since the stomach of the child is adapted first of all to the digestion of milk, and since the composition of milk is entirely different from that of meat, some of the best writers on the diet of children say very emphatically that meat should not be given to young children.

When the child begins growing vigorously, as he does between the ages of eight and fifteen years, meat is especially desirable. After the growing age is past we can get along with less meat, and when we get old we should, like little children, eat it very sparingly. When we become very old, we shall find, as is true of little children, that milk is again the best food for us.

What are the meats most suitable for food? In general it may be said that the meat of all animals is edible, but in many cases, through religious law or through custom, we reject certain animals for food and accept certain others. The common meat-producing animals are cattle, hogs, sheep, and goats. Among the feathered tribes, chickens, turkeys, pigeons, partridges, ducks, and geese, both domesticated and wild, are used for food. Among the finny tribes there are hundreds of edible varieties; in fact, there are few fish that are not edible. We have, therefore, a wide range of choice, and we

are generally disposed to divide our meat diet into the three classes named—flesh, fish, and fowl—meaning by flesh the edible portions of cattle, hogs, and sheep. We may also divide meat into two classes, red and white, meaning by the term meat largely the muscular portions of the animal. The animal fats, though they should be included under the term meat as well as the muscular portion of the animal, are not usually so considered. This is not a correct view, however, because no matter how lean the meat it always contains some fat, and a little fat adds much to the flavor and character of meat.

There are certain animals that, although edible, yet are not used widely for meat. Moses, in the book in which he advises the proper diet for his people, permitted the eating of all animals that have a cloven foot and chew the cud. This would include the cow, the sheep, and the goat. So according to the law of Moses pork was



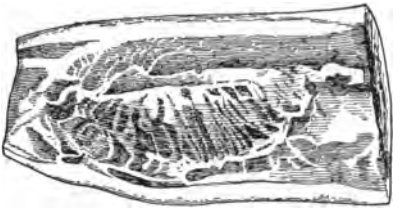
A steer ready for market

forbidden, because although the pig has a cloven foot he does not chew the cud. By the same law the use of horse meat was also forbidden, since the horse neither chews the cud nor has a cloven foot. Experience has shown, however, that horse meat is entirely suitable for eating, and in fact in some countries in Europe it is eaten in considerable quantities. But the horse is not often used as food until the animal is too old and bony to be good for any other purpose. Naturally the meat of such an animal cannot be very inviting, and for that reason horse meat is not considered by most people to be very good. Horse meat is not much eaten in the United States, although a great deal of it has been shipped out of the country for consumption in Europe.

Horse flesh is sometimes used as meat

The hog, however, has come into general use as food, and by many persons pork is relished more than any other kind of meat. The flesh

of the hog is especially suitable for curing, far more so than that of any other meat-producing animal. For that reason comparatively little hog meat is eaten fresh. The great quantities sold of smoked and cured hams, shoulders, and bacon prove the truth of this statement.



A side of bacon

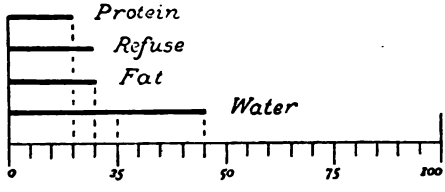
On the other hand, most of the meat of beef cattle is eaten fresh, much of it being kept in a fresh state in cold storage. Considerable quantities of beef, however, are pickled and preserved in brine, and this product is known as corned beef. Mutton, the flesh of sheep, is also usually eaten fresh. Mutton does not readily lend itself to preservation, except by cold storage.

Fish should be eaten in as fresh a condition as possible, though it is sometimes necessary to keep them in cold storage during transportation to the place where they are to be sold.

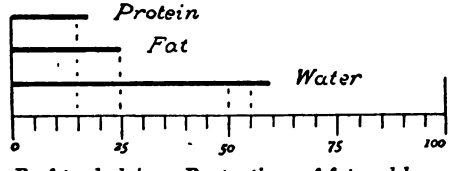
Fowls are best for food when fresh, although immense numbers of fowls of all kinds are kept in cold storage, some of them entirely too long so far as their tasting qualities and wholesomeness are concerned. Yet it is quite true that the flesh of poultry and of wild fowl or game if

kept for a certain length of time at a low temperature is improved in flavor and taste. And it is a well-known fact that beef is much improved in flavor by being kept for from three to six weeks at a temperature near the freezing point.

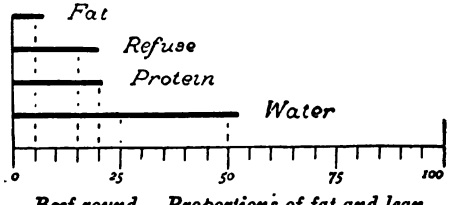
But to keep articles of food in cold storage for an indefinite length of time allows them to lose in both taste and quality. It also renders the foods less wholesome. Cold storage, therefore, should be practiced with moderation, and rarely should articles of food be left in cold storage for a period longer than six or nine months.



Ribs of beef. Proportions of fat and lean



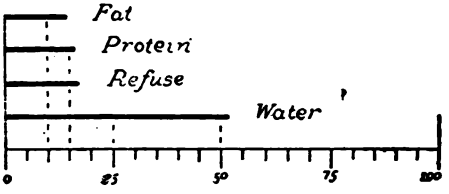
Beef tenderloin. Proportions of fat and lean



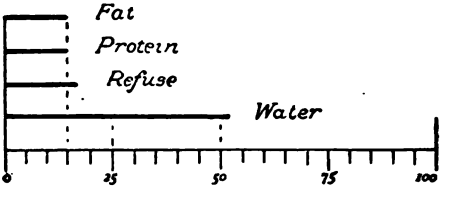
Beef round. Proportions of fat and lean

What is the composition of meat? Not only does the meat of different species of animals vary in its composition, so the meat of different animals of the

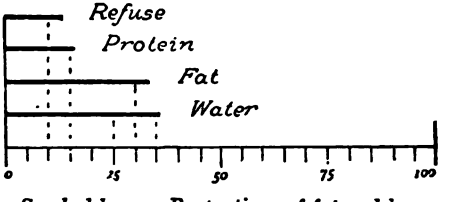
same breed. All meats, however, contain the same principal food elements. For that reason it will be necessary to give only in a general way the composition of the flesh of edible animals.



Leg of lamb. Proportions of fat and lean



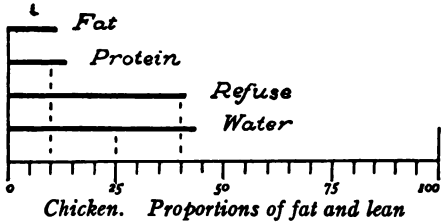
Leg of mutton. Proportions of fat and lean



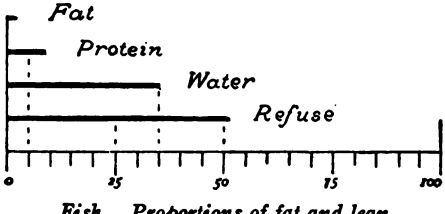
Smoked ham. Proportions of fat and lean

The edible portions of all animals consist almost entirely of fat or oil and protein. The muscles, the tendons, the nerves, and the brain are made up largely of protein. The bones, which we cannot eat because of their hardness, consist principally of a mineral substance—phosphate of lime. They also contain a large amount of protein. This is sometimes extracted from the bones, making what is known as gelatin. But compared with red meat, gelatin is not a nutritious food.

The muscular portions of meat, as we have learned, are almost pure protein—that is, they consist almost exclusively of substances containing nitrogen. The proportion of protein to fat in meat varies greatly, according to whether the animal is thin or fat. It varies also according to the part of the animal eaten. The sides of the hog, from which bacon is made, are composed mostly of fat, with only an occasional streak of muscular matter passing through the fat. The muscular portions contain more or less fat according to the nature of the animal and the way it is raised. As a rule, probably half of the edible portion of animals is fat. This of course includes the fat stored in various parts of the animal's body. Some parts of the hog are nearly all fat.



Chicken. Proportions of fat and lean



Fish. Proportions of fat and lean

It must not be forgotten that we do not eat all the fat of an animal in the form in which it is originally found. Besides the fat we eat with the meat of the hog,

a great deal is made into lard. From fat cattle and sheep we get tallow, which is often not used for food at all but for soap making and other purposes.

The edible portions of wild game and of most varieties of poultry are more lean than fat. On the other hand both pork and beef have more fat than lean. In fish, also, the amount of protein or lean meat generally exceeds the amount of fat.

The data given in the diagrams in this chapter refer to meat as purchased and not as prepared for the table. They do not include the quantity of mineral matter (ash) or other elements which may be present in small quantities.

QUESTIONS TO HELP THE PUPIL

1. Name three animal foods. Which one is used most? 2. What leads us to believe that animal foods are to be eaten by man? 3. What is meat? 4. At what age may children begin to eat meat? 5. What meat should not be given to children? 6. At what age is fresh meat especially desirable for them? 7. What are the common meat-producing animals? 8. Into what three classes are meats divided? 9. What animal is edible though not widely used for meat? 10. What kind of meat is usually cured? 11. What kind is usually eaten fresh? 12. Does storing meat for a short time at a low temperature improve its flavor? 13. What happens when meat is kept in storage a long time? 14. Of what two food elements does meat consist almost entirely? 15. Of what does the muscular or lean portion of meat consist?

IX. Preserving Foods

What is the purpose of preserving foods? Nature produces foods in greatest abundance at certain periods of the year, as during the summer. In temperate regions at other seasons, as during the winter, under natural conditions no vegetable foods or fruits are produced. Though meats, fish, and poultry may be had at all seasons of the year, yet they are more abundant at certain times than at others. For this reason if we had no method of preserving foods we might have too great a supply of food during one part of the year and far too little during another. Hence, in order to have a more even supply of food throughout the entire year, it is necessary to preserve foods.

Do all foods need preserving? There are some foods which may be safely kept a long time, since their natural qualities make them resist decay. Good examples of these foods are the ripened kernels of wheat, corn, oats, rye, and other cereals. When kept dry and free from insect pests, these foods may be stored for a year or longer without losing in taste and flavor or becoming less wholesome. In fact, cereals to a certain extent improve with age. They are [illegible] for milling and for general handling after

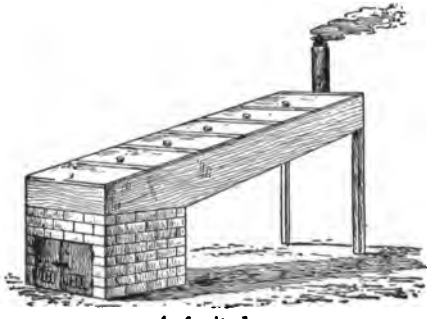
they have been kept a few months than they are immediately after being harvested. This is because they dry out and thus become hard and better able to resist decay.

Succulent vegetables may also be kept for a considerable length of time without loss of quality. For instance, potatoes, turnips, beets, radishes, and cabbages, and fruits of many kinds, such as apples, pears, and oranges, may be kept for many months if put in a cool, dry place and protected from freezing. But vegetables do not retain their good qualities nearly so well as do the cereals, and fruits also are better if not kept too long. Certain fruits, such as strawberries, raspberries, and blackberries, keep only a few days. Peaches and apricots keep for a comparatively short time. Many foods which are eaten before they are ripe, such as green corn, will keep only a few hours without losing in taste and quality. Green corn and green peas lose very rapidly in quality after having been plucked from the stalk. If you wish to eat green corn or green peas the best plan is to go into the garden or field, gather the vegetables, and cook them immediately. In this way you get these delicious foods with their greatest sweetness and tenderness.

Flesh food, whether of domesticated animals, poultry, wild game, or fish, loses rapidly in

quality, especially in warm weather. It may be said to begin to lose in quality from the moment the animal is slaughtered, although it may be many hours or even days before this becomes evident in the taste and the odor of the article.

What methods are used in preserving perishable foods? There are several well-known methods of preserving perishable foods, some of which are good and others highly injurious. Inasmuch as it is the large amount of water in foods that promotes spoiling, one of the oldest and best methods of preserving these products is by drying. Fruits may be spread in the warm sun and in a few days dried sufficiently to keep a long time. In localities where the air is very pure and dry, as in Arizona and New Mexico, fresh beef hung up on a pole is dried so quickly that it will keep its qualities for months. This product is called "jerked beef."



A fruit dryer

Dried beef, well known in commerce, is produced by exposing the meat, after it is properly salted, to artificial heat or to the natural drying process of the air.

Usually, artificial heat is used in drying fruits that spoil quickly; that is, the fruits are sub-

Drying raisins in trays in the open air

jected to hot air at a temperature that will not char or bake them, but yet dry them out rapidly. The air is warmed by a furnace built for that purpose. This air is then conducted over the fruit to be dried. Hot air absorbs a great deal more moisture than cold air.

In this country the principal foods preserved by drying are the fruits. Annually vast quantities of peaches, apples, pears, apricots, and other fruits are dried. Grapes are also dried, the resulting product being known as raisins. One of the greatest centers of the dried-fruit industry is in California. There the long, hot days and periods of dry weather make it possible to dry almost every kind of fruit by means of the

sunshine alone. In rainy countries this drying process is difficult because of the rainstorms

Women preserving fruit by canning

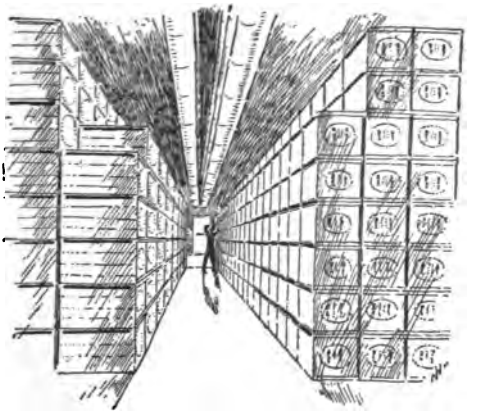
which come often and with little warning.

Vegetables of various kinds, too, are dried, but this industry is not so great as fruit drying because of the difficulty of restoring the dried vegetable to its natural condition when preparing it for eating. Potatoes, sweet corn, and various succulent vegetables have been dried successfully, but to no such extent as the fruits.

What is another good method of preserving perishable foods? More than a hundred years ago a French chemist by the name of Appert discovered that if perishable foods are heated to the temperature of boiling water and kept so for a certain length of time, and are then

inclosed in air-tight packages, they will keep indefinitely. This was the beginning of what is known as the canning industry. In canning perishable foods, such as vegetables, fruits, meats, milk, and other products, they are heated to or above the temperature of boiling water for varying lengths of time and then placed in containers which are sealed to keep out the air. This is one of our great industries. The articles canned in this country are chiefly fruits, tomatoes, green corn, peas, beans, meats, and milk, although almost every kind of food may be preserved in this way.

What food products are commonly kept in cold-storage warehouses? This is a very important question and one concerning which every one should have exact information. The common foods kept in cold-storage warehouses are, first, meats of all kinds, poultry, fish, and game. In addition to these artic



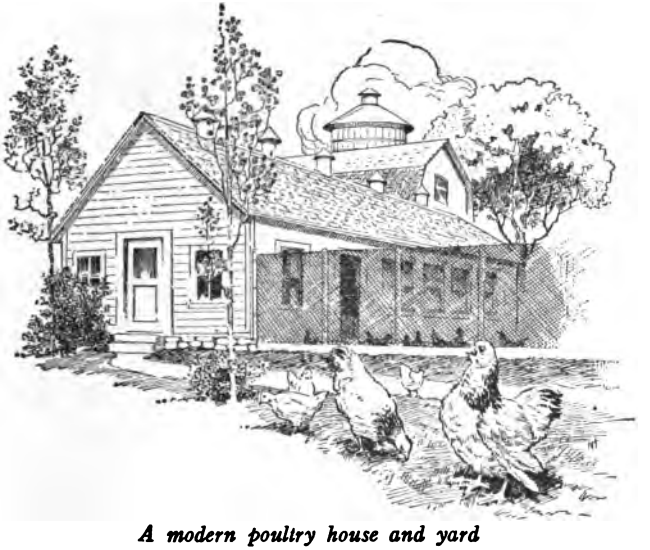
Interior of a cold-storage warehouse

the product most commonly placed in cold storage is eggs. Fruits of all kinds, particularly apples, are also placed in cold storage in great quantities.

At what temperatures are these foods kept? Poultry and fish are kept at a temperature much below the freezing point of water. The result is that the poultry and the fish become frozen solid and remain in that condition in the cold-storage warehouse until sent to market. Sometimes meat also is frozen; for instance, much of the fresh meat shipped from Australia to Great Britain. But most beef is kept at a temperature just above the freezing point. Eggs are kept at a temperature at which they will just escape freezing, the nearer to the freezing point the better. Milk and cream also are kept at temperatures just above the freezing point.

How long should foods remain in cold storage? There is only one answer to this question—just as short a time as possible. There are certain kinds of foods which need to be kept in cold storage only for the length of time necessary to transport them to the place where they are to be sold. Such foods as these are fish and poultry. The fishing season extends over nearly the entire year, so it is possible to secure reasonably fresh fish at almost all seasons. Eggs and 'ckens are more abundant in the spring and

early summer than at any other time, but by care in arranging hatching periods, which is



A modern poultry house and yard

made possible by modern methods of poultry raising, young chickens may be produced at all seasons of the year. Poultry therefore need be kept in cold storage only long enough to transport it and sell it.

Butter is another product which is more abundant in the spring than at any other season. Hence large quantities of butter are put into cold storage in the spring to be sold during the following winter. The abuse of cold storage lies chiefly in the practice of keeping these products

—fish, poultry, butter, and eggs—for too long a time in order to influence prices or for other reasons. One great need in regard to cold storage is that every food product kept in storage longer than the time necessary to transport and sell it, should be so marked that the buyer may know what he is getting and how long it has been in storage.

Churning butter

Another abuse of cold storage consists in storing products that have already begun to decay. Of course articles in such a condition can never be improved. By awakening the public to the danger of such practices they can be stopped.

Is there any other method of preserving foods? Yes, one of the most important methods of preserving foods has not yet been described. It may be termed the "pickling method." This method is used in preserving both meats and vegetables. We are all familiar with the ordinary pickles of the household, made chiefly from the cucumber. The ordinary vegetable pickle is usually preserved by means of salt, sugar, and

vinegar. In addition to these three articles many spices are used in pickling, largely because of the flavor or taste which they give to the product.

The principal material used in the pickling of meats is salt. The product known as "mess pork," of which great quantities are used, is hog flesh preserved principally in salt, or in a strong solution of salt called brine. In the preparation of pork for bacon or ham, the flesh of the freshly slaughtered hog is first treated with salt in such a way as to make the salt spread as nearly as possible through every part of the meat. When pickling thick pieces of meat, the salt is injected into the meat with a syringe, as well as rubbed on the outside.

After the salt has thoroughly spread through the meat it is put through another process, known as curing. The bacon and the hams and shoulders are hung in a room filled with smoke, produced usually by burning green wood, preferably hickory or oak. In the old-fashioned method of curing, this process is repeated once a month and the method of curing is slow. But in the great packing houses the hams and bacon are placed in closed chambers at a high temperature and large quantities of smoke forced into them, so that the smoking will occupy only a few hours. That is

reason why the products prepared in the packing houses never reach the grade of excellence of the products prepared in the old-fashioned way.

In order to preserve the red color of meats saltpeter is often used in small quantities at the time of salting. Saltpeter has the property of producing a bright red color in the muscular fibers which closely resembles the natural color. Thus when ham or bacon is cut the muscular fibers are a bright red and look like fresh meat. This practice should not be permitted for two reasons: first, because the color is deceiving; and second, because chemicals of this kind, if used in any considerable quantity, have a distinctly harmful effect on the health.

Beef is preserved in the same way as pork, although not a great deal of it is smoked. It is usually preserved in brine, and is then called "corned beef." Common salt and saltpeter are the chief ingredients used in corning beef.

What is catchup? One of the preserved vegetable foods in common use is known as catchup. Catchup is made usually of tomatoes to which vinegar, salt, spices, and sugar are added.

To what is the color of catchup due? In catchup that is properly made the red color is due solely to the tomatoes. For this reason ripe red tomatoes are used. Whenever catchup is artificially colored, which at the present time is

not often the case, you may be certain that the tomatoes used were not of the proper color or degree of ripeness. If green tomatoes have been used the catchup will not have the right color. Only red, ripe, perfect tomatoes should be used in the manufacture of catchup. In order to get the best color the catchup should be made quickly. This is possible in large factories which have the machinery and equipment for the process. For that reason the catchups made by large manufacturers have a more decided red color than those made at home.

A tomato plant with fruit

What keeps catchup from spoiling? Catchup is kept from spoiling by being heated to a high temperature when made. If it is of the proper

density, that is, if it has from twenty to thirty parts of solid matter to one hundred parts of liquid, and if it contains the proper quantity of sugar, spices, and vinegar, the catchup will keep for a considerable length of time after the bottle is opened. Catchup should not be used after the bottle has been opened more than three or four days, unless it is kept in a refrigerator.

A bottle of catchup

What are some of the adulterations of catchup? Sometimes catchup is made of the cores and skins of tomatoes, or of green and imperfect tomatoes, or by mixing pumpkins and the cores and skins of apples with the tomatoes. Such adulterated catchup should be avoided. Catchup is preserved sometimes by adding benzoate of soda, a harmful substance, but that practice is disappearing.

What is jelly? "Jelly" is the term applied to the substance derived from boiling a fruit juice to which a certain amount of sugar has been added. This substance after cooling has the property of hardening to an elastic, jelly-like mass. Among the fruits used for making jellies are berries, apples, plums, and grapes. Children should not eat jelly to any extent until they are old enough to control their appetites.

Should preserved foods be entirely excluded from our diet? The preservation of food products is an extensive industry and one of great value and importance. But there is no food that is not to a certain extent injured in quality by the process of preserving. However, though there may be a slight danger to health from the salt, the vinegar, and the spices used in preserving, the well-known preserved products need not for that reason be entirely excluded from our food lists.

QUESTIONS TO HELP THE PUPIL

1. Why do we preserve foods? 2. Name some foods that are more resistant to decay than others. 3. How must succulent vegetables be kept to preserve their good qualities? 4. Name a vegetable and a fruit that will keep only a very short time. 5. What is an old method of preserving fruits and meat? 6. What is "jerked beef"? 7. Which state is a great dried-fruit center? 8. What method of preserving foods was discovered by Appert? 9. What is meant by cold storage? 10. At what temperature are poultry and fish kept? Eggs and milk? 11. What is the danger of cold storage? 12. What is the longest period any food product may be kept in cold storage? 13. How are vegetables "pickled"? 14. What is added to give flavor? 15. How is meat pickled? 16. What is brine? 17. What is the process known as "curing"? 18. What substance is often used to color cured or pickled meats? Why is this practice condemned? 19. What is catchup? How is it kept from spoiling? 20. Explain how catchup is sometimes adulterated. 21. What is the effect of preserving treatment on any food? Should we let this keep us from using such foods?

X. Nuts as Food

What is the food value of nuts? The food products known as nuts are the fruits or seeds of certain trees and bushes. They are composed chiefly of protein and fat, and so have a high food value. All nuts also contain a considerable quantity of sugar, but only a few, such as the chestnut, contain much starch.

Are nuts better for food when raw than when roasted? The answer to this question is both yes and no. Many of our common nuts are excellent in the raw state. Especially is this true of walnuts, hickory nuts, and pecans, all of which belong to the same general family. The flavor and character of nuts of this kind are not improved by heat. But there are other nuts which are much more pleasing in taste and flavor after being roasted than before. Among these the most important are the peanut and the chestnut. Both of these nuts are greatly improved by roasting. In fact, the peanut is rarely, if ever, eaten raw. It then has a harsh, bitter taste quite different from and much less agreeable than that developed by roasting it. The chestnut is agreeable to the taste both in its raw and in its roasted state, but is considered much more agreeable when roasted.

What are some of the principal varieties of nuts? It is not necessary to tell the boys or girls who live in the country much about the common kinds of nuts. You cannot go into the forest in the autumn without finding them. The nuts found most commonly in the forest are those that grow on oak trees. They are called acorns. The oak is one of the most majestic trees of our forests. Oak trees live to a great age and in favorable soil and climate grow to a great size. The acorn is a beautifully formed nut, growing out of its cap in the interesting way you all know. Acorns are gathered for food by squirrels and birds. Hogs are particularly fond of them. In the autumn many a farmer turns his hogs into his oak forest, where they fatten on the acorns.

A white oak tree

Acorn fruit and leaf

Another nut found on forest trees is the beechnut. In shape it is triangular like a grain of

buckwheat. It does not grow so large as the acorn, but it is much more pleasing to the taste, although it is rarely found in the markets. Only those children who live near a beech forest really understand what excellent eating beech-nuts are.

A third important nut of the forest is the hickory nut. Hickory nuts are justly classed as among the best flavored of all nuts.

The pecan, which grows only in the southern part of our country, is another of our finest nuts. It is not found to any great extent north of Tennessee and North Carolina, and grows best south of these states, in Georgia, Alabama, Louisiana, Mississippi, South Carolina, and Florida. The pecan is now being cultivated in large orchards in various parts of these states. The cultivated varieties are large, with very thin shells and large kernels. The pecan is a great favorite with a large class of people.

Many other kinds of nuts grow wild, and among these one of the best is the hazelnut. The black walnut also, with which the American boy is acquainted, was a very common nut until our walnut forests began to disappear. The black walnut tree was always to be found on very fertile land, in this respect resembling the maple. In clearing the land for farms, the early settlers preferred the richest lands, and

so quite naturally the walnut and maple trees were the first to disappear. No longer are the farmer boy's hands stained with the walnut juice, once so common a sight during walnut-gathering time in October and November, after the frosts. From the outer covering of the walnut our grandfathers and grandmothers extracted a stain which they used in dyeing.

A walnut tree

The butternut is an elongated walnut with much the same taste and character as the walnut. The English walnut is a thin-shelled, cultivated walnut, which differs in many ways from the wild walnut of the American forests. All these different varieties of nuts grow on trees, with the exception of the hazelnut, which grows on a shrub or bush.

What is the difference between the peanut and the nuts that grow on trees? The peanut is the fruit of an annual plant. Instead of growing above the ground as other nuts do, it grows underground. The flowers from which the peanuts develop grow above ground on long, bending stems. These stems bend to the ground

and burrow under the surface, where the nuts form and ripen. The peanut grows best in the southern states of our country, being raised in great quantities in southern Virginia, North Carolina, and Tennessee.

A peanut plant

The peanut is used principally as a food for human beings. It is always roasted, a process which, we have already learned, improves its taste and aroma. The peanut is one of the important features at open-air meetings, picnics, and public gatherings of all kinds. The baseball game, the football game, the horse race, and the circus would hardly seem real if the noisy venders of peanuts and popcorn were not present to satisfy the popular demand for these products. Peanuts are a wholesome and nutritious food product, but are usually eaten in such large quantities as to unbalance the ration. By this is meant that too great a quantity of protein and oil in proportion to other food elements is taken into the body. Peanut butter is made by crushing roasted peanuts.

What relations have nuts to health? When used in the proper quantity, nuts are a valuable addition to our food supply. Nuts may also be used to advantage because of their direct benefit to the health. In this respect they may be classed with fruits, being not only food products but health-food products. Because of its oily nature the nut acts as a natural laxative, tending to correct constipation, a common condition among people of all ages and occupations. This fact, however, does not justify the fads of some food experts who tell us to eat nuts only. It is more than likely that it would be injurious to health to exclude from the diet all food products except nuts. But a more widespread use of nuts as food is advisable for the best interests of health. It is also better to eat a few peanuts once every day than to eat a large quantity one day and none at all for a week.

Are there any dangers in eating nuts? It has already been pointed out that by eating nuts to excess you may take in more protein, and especially more oil, with your food than is advisable. In addition to this, you must be careful when eating raw nuts to avoid eating insects and their eggs. The nut is an ideal food for certain insects. The mother insects understand this and that is why they bore through the shell and lay their eggs inside the

nut. Certain wild nuts, especially the chestnut, are apt to be infected in this way. Roasting the nuts is a complete guarantee against the danger of taking the living eggs into the stomach. Still, many of us do not like to eat worms, even though they are well cooked.

Fortunately, most of the nuts we eat are easily inspected, and the worm is always honest enough to make itself known when the shell of the nut is removed. If the nut has been infected the results are always visible, and with a little attention it is easy to guard against danger from this source. Moreover, the danger is very slight, since it is not at all likely that any of the insects or the eggs found in nuts will continue to develop in the intestines. Yet such things sometimes do happen, especially in children. Various sorts of worms infect the alimentary canal of young persons. Some of them may be harmless, but all are disagreeable and some, like the tapeworm, are positively dangerous. None of these insect pests are natural to the intestine. They are all introduced from without, usually in the form of eggs and generally with our food.

Hence cooking, while it may injure the taste of some foods, prevents insect infection, which is always more or less threatening to health. Therefore children eating nuts should carefully

inspect them beforehand and reject all that show any evidence of insect ravages.

When should nuts be eaten? As a rule, nuts should be eaten at mealtime. As a matter of fact, however, a large proportion of the nuts that are eaten, especially by children, are taken between meals. This is not especially objectionable if only a few are eaten, but to eat large quantities of nuts between meals is dangerous, not because they are nuts but because fresh quantities of undigested foods are added to those that are partly digested.

QUESTIONS TO HELP THE PUPIL

1. Of what food elements are nuts chiefly composed? 2. Why are peanuts better after roasting? 3. How does the peanut taste when it is raw? 4. Why is it better to roast chestnuts? 5. Name all the kinds of nuts that you know. 6. What kind of nuts do hogs like? 7. What kind do you like best? 8. For what was the outer covering of the black walnut used in early days? 9. How do peanuts grow? 10. Why should we avoid eating large quantities of peanuts or other nuts? 11. Of what should we be careful when eating nuts? 12. When should nuts be eaten? Why not between meals?

XI. Beverages

What kind of beverages should the child use? Children should drink nothing but pure drinking water or pure milk. All other beverages are unnecessary, habit-forming, and injurious.

What is pure drinking water? Pure drinking water is not exactly the same thing as pure water. Pure water is water that contains nothing besides water. It is very difficult to obtain. The ordinary distilled water used by druggists cannot be said to be entirely pure. Distilled water, moreover, is not the best drinking water for children. For them the ideal drinking water is spring or well water that has not been infected by water pouring directly into the well or spring from the surface of the ground near it. The ideal drinking water contains a certain quantity of the mineral substances present in the soil through which the water percolates or oozes on its way down.

How much mineral matter is found in good drinking water? The quantity of mineral matter in water varies with the character of the rocks with which the water comes in contact as it percolates through the earth. Limestone is much more readily dissolved than sandstone, lime is usually the chief mineral found

in water. When spring water does not pass through limestone, other mineral substances are found in it, but usually not in large quantities. When small quantities of mineral matter are present the water is said to be "soft"; when large quantities of mineral, especially of magnesia and lime, are present, it is said to be "hard."

An old-time well-sweep

Which is more wholesome to drink, hard water or soft water? Usually a soft water that contains just the proper proportion of mineral matter is best for drinking. If the water is too hard it may contain more mineral substances than are necessary for good health.

Can hard water be softened? Hard water may be softened in two ways. In hard water there is often a large amount of carbonic acid holding a certain quantity of minerals in solution. If the water is boiled the excess of carbonic acid is driven off and the minerals which were held

in solution by the excess of carbonic acid are released and deposited on the bottom and sides of the vessel in which the water is boiled. Thus by the simple process of boiling, some hard waters are rendered more or less soft. Tea-kettles used for boiling hard water become covered inside with a mineral deposit. If hard water does not soften by boiling, it can be softened by adding washing soda, borax, or ammonia. But water softened in this way must not be used for drinking.

What is the best location for a spring? We have no choice in the location of springs. Nature has decided that for us. But we may choose between springs, when more than one is available. In selecting a spring as a source for drinking water the locality from which the waters are believed to come should always be carefully inspected. A spring on an uninhabited hillside or mountain provides an ideal drinking water, cold and clear and without injurious substances.

A hillside spring

But the water in a spring may really come from a much greater distance than we suppose. So it is not always possible by inspecting the immediate neighborhood of a spring to determine the character of the soil through which the waters pass. For this reason we should call on the geologist, who will find out for us how the layers of rock are slanted in order to discover from which direction the water comes.

The only way we can be sure about the character of water is to have it carefully examined. The chemist will tell us what minerals the water contains, and the bacteriologist will tell us all about the bacteria or organisms which may be found in it. Spring water coming from uninfected localities will be almost sterile; that is, it will contain almost no living organisms. The smaller the number of organisms or bacteria a water contains, the better it is for drinking.

The wise general does not permit his soldiers to drink water in an enemy's country until it has been analyzed. During the Japanese-Russian war chemists and bacteriologists were sent ahead of the Japanese troops in Russia to put up notices as to the waters that were good to drink and those that were to be avoided.

How much water should we drink? The body requires a greater quantity of water than we can get indirectly as a part of the foods

which we eat. So the human animal needs to take a good deal of water in addition to the water in the food he eats. The amount needed varies with the character of his food, the temperature of the atmosphere in which he lives, and the amount of physical exercise he gets. The drier and saltier the food, the greater the quantity of water needed. The higher and drier the atmosphere, the greater the quantity of water needed; and the more vigorous the exercise, the greater the quantity of water needed. Thus a person who eats very dry, salty food in hot weather, and at the same time engages in vigorous manual labor or violent exercise, requires most water. It follows that we need the greatest quantity of water in summer and the smallest quantity in winter.

Though much water is formed from the oxidizing, or burning, of the foods in the body (Book I, page 90), there is still not enough for the needs of the body without drinking additional quantities.

When should we drink water? A good rule to follow is to drink when thirsty. Another good rule is to drink a certain quantity of water at regular intervals, whether thirsty or not. Formerly it was quite generally believed that we should not drink with our meals. This idea was a valuable one, although recent investigations

have shown that, if the food is very dry and is not well chewed, a considerable quantity of water may be taken at mealtime and not only not interfere with digestion, but even promote it.

As a general rule it is best not to drink water when eating. During the process of chewing, the salivary glands are actively engaged in secreting saliva and mixing it with the food, a process useful to digestion, especially of starchy foods. To drink water while we are chewing our food makes the salivary glands less active and so the flow of saliva is diminished. Thus, although the water in itself is not harmful, it interferes with the secretion of saliva and its admixture with the food, a process that is necessary for good digestion. Yet at the same time it is well to remember that the proper digestion of the food in the stomach and in the small intestine is checked if the contents of the stomach and the intestines are too dry. So it seems that the best plan is to drink water rather freely either before or directly after eating but to refrain from doing so during the meal in order that the salivary glands may properly perform their function.

At all events, we should not neglect to drink water. If we eat five pounds of food a day, including water as food, nearly four pounds of it should be water.

When should we drink milk? Young children and growing children should drink milk at least three times a day. Milk is not only a beverage but a highly valuable food. It contains about eighty-seven per cent of water; to that extent it is a beverage. But the other thirteen per cent is made up of certain food elements so ideally balanced that all the tissues of the body are nourished with the best possible benefit.

Lunching on milk and brown bread

When we see a boy sitting at a table eating good brown bread made of whole-wheat flour, and drinking pure, clean, fresh milk from healthy cows, it makes the heart rejoice, because we know that boy is getting the best possible food and in the very best form. When he adds to these things vegetables, fruits, and nuts, we may be certain that he has all he needs to

nourish his body and properly promote growth.

Too often children, after the years of infancy and early childhood are past, give up the habit of drinking milk. It would be better if the habit of drinking milk were fostered rather than abandoned. A quart of milk a day is little enough for a growing child. But pure, clean milk is an expensive food. Happy indeed the family that can keep a cow, especially so if careful attention is paid to keep her healthy, clean, and well fed.

What are the effects of sour milk on health? Most experts believe sour milk to be wholesome, and it is especially recommended in certain irritated conditions of the stomach when ordinary fresh milk cannot be taken. Many persons believe that the constant use of sour milk, either buttermilk or ordinary sour milk, is not only healthful but will make people live longer. While sour milk is wholesome, and to that extent helpful in prolonging life, it is impossible to believe that a diet of sour milk will relieve us of all the ills that necessarily attend old age. Perhaps people who need more acid food might go a much longer way toward the century mark if they drank buttermilk or sour milk more freely.

Few people live to be a hundred years old, no matter what they eat or drink, but many

of us could come nearer to living one hundred years if we were more careful of what we eat and drink.

A coffee tree

What is coffee? Coffee is the fruit of a small tree. The coffee tree is larger than a bush and smaller than an ordinary tree. Coffee is one of the most important agricultural products of Brazil, Mexico, Central America, the Hawaiian Islands, Java, Arabia, and other tropical parts of the world.

What are some of the principal varieties of coffee? The different varieties of coffee are given the name of the country in which they are raised, or the name of the town or port from which they are shipped. Sometimes coffee is sold under a special name given by the dealer. Most of the coffee used in the United States is grown in Brazil in South America, and is shipped to the United States from the two great ports, Rio de Janeiro and Santos. The coffee shipped from Rio de Janeiro is called Rio, and that shipped from the Santos harbor

is called Santos coffee. The most celebrated coffees on the market are those produced in Arabia, and known to the trade chiefly as Mocha. In the Dutch East Indies a very fine grade of coffee is also produced, which is incorrectly known as Java. The island of Java itself does not produce a high-grade coffee, but it has given its name to the coffees produced in the Dutch East Indies. A high-grade coffee is also grown in small quantities in Mexico, Porto Rico, and the Hawaiian Islands. But these varieties, though of excellent quality, are not important as to quantity.

What are the various grades of coffee? Coffees are divided into nine grades, numbered from one to eight, while the lowest grade is known as "no grade." The classification of coffees is determined chiefly by the number of imperfect grains. Grade No. 1 is supposed to have practically no imperfect grains. In Grade No. 2 a few grains are imperfect, in Grade No. 3 a few more than in No. 2, and so on in increasing numbers up to Grade No. 8.

Why is coffee roasted? Coffee grains that have not been roasted are so extremely tough that it is difficult to grind them. Besides, coffee made from them in that condition would not be pleasing to the taste. The roasting of the grain develops its aromatic properties and makes

it brittle, easy to grind, and suitable for making the popular beverage known as coffee.

What are the active principles contained in coffee? The aroma and flavor of coffee are due to certain oils developed by the roasting. The coffee berry also contains a considerable quantity of sugar, most of which is converted into caramel, or burnt sugar, during the process of roasting. It is chiefly this burnt sugar which gives the color and part of the taste to the beverage made from the coffee berry.

But the most active principle in coffee does not have any noticeable taste or odor. This is the element, however, that produces the exhilaration, animation or liveliness, that is felt after drinking coffee. This substance is called *caffeine*. It is the same as a substance called *theine* in tea. Caffeine and theine belong to that class of substances known as *alkaloids*, other common types of which are quinine, morphine, cocaine, and nicotine. Alkaloids as a rule are poisonous. Caffeine is not a poison, as that term is generally understood, but it is a substance which may produce serious injury when taken constantly or in too large quantities.

There is also a considerable quantity of *tannin* in coffee. Tannin adds something to the taste of coffee but little or nothing to its wholesomeness.

What is the effect of caffeine upon health? Grown persons who are strong, vigorous, and well nourished are able to drink coffee in moderate quantities without any apparent harm. With children the case is quite different. No child can possibly drink coffee, even in the smallest quantities, without being harmed. It is a beverage, therefore, which should never be included in the diet of children. In fact, no one should drink coffee before the age of at least eighteen years, if ever. It would be still better if the habit were never formed.

Coffee acts especially as a stimulant. If we feel tired because of physical or mental exertion, that is nature's signal that we should rest. If instead of resting a tired person drinks a cup of strong coffee, the feeling of fatigue will disappear and he feels able to do more work. But such work, we must remember, is done at the expense of tissues already exhausted, and cannot be regarded as healthful. It is far better to rest when we feel tired than to drive away signals of distress by taking any stimulant, even one so mild as coffee. Even grown persons who drink coffee should do so only with the greatest moderation.

Does coffee affect all people in the same way? Some people are able to drink large quantities of coffee without apparent harm; others are

affected by a very small quantity. Many grown people who drink a cup of coffee late at night find as a result that their sleep is disturbed, wakefulness often continuing throughout the night. Others may drink three, four, or even five cups of coffee during the day and not suffer from sleeplessness. But it is not advisable to take stimulants except in special cases when they will help to carry one over a certain period in which extra exertion is absolutely necessary.

The person who continually works under a stimulus may not feel it for many years, but he is almost certain to break down before his natural time. The drinking of coffee, therefore, cannot in most cases be regarded in any other light than as dangerous to health, and should be absolutely forbidden to children.

What can be said of the practice of tea drinking? There is much difference of opinion among experts who have studied the question as to which is more harmful, tea or coffee. In a question of this kind it is well to give both sides the benefit of the doubt.

We are now speaking in the interest of the child especially. Grown people undoubtedly have the right to use tea and coffee as they see fit, but even they should use them temperately. *The use of tea and coffee tends to establish a habit.*

Some people begin their day by drinking one, two, or more cups of strong tea or coffee. If for any reason they are deprived of this stimulant they are miserable the rest of the morning. Very soon they have a headache and do not feel inclined to do anything but find fault.

A branch of the tea plant

Whenever you eat or drink anything which has practically no food value, and you are made unhappy when forced to do without it, you may be sure that you have formed a habit and one that is injurious. Recently a census was taken among the school children of a large city to discover how many of them drank tea or coffee for breakfast. It was found that about half of the children did drink either tea or coffee. Thus the fear that tea and coffee are becoming a real danger to the children of the country is not an idle one, if we accept the statement that one half of the children in school are forming the tea and coffee drinking habit.

A short time ago the health officers of the city of Washington issued a circular to the parents whose children attended the public schools urging them not to allow their children to drink tea or coffee. The circular stated that children who were in the habit of drinking tea and coffee were restless, more or less disobedient, negligent of their studies, and were physically unfit to do good work in school. Practically all competent authorities on diet agree that children should not drink tea or coffee at any time.

What is the active principle contained in tea? The active principle in tea is known as *theine*, a substance that is exactly the same as caffeine. Caffeine is the proper scientific term for both. Tea, like coffee, also contains large quantities of tannin. This substance acts on the pores of the membranes lining the inside of the intestines, tending to contract them and stop them up. This is easily proved by placing a little tannin in the mouth. The mouth at once feels, as we say, puckered. Any one who has eaten a persimmon that was not ripe understands this sensation or feeling. The unripe persimmon contains large quantities of tannin, which produces the effect described. Considerable quantities of tannin introduced into a child's stomach in tea and coffee tend to hinder digestion,

produce constipation, and so injure his health. It is true that most of the vegetable foods we eat contain more or less tannin, and that it is not possible to exclude it entirely from the diet. But we should not take any more of it than we have to, and above all it is not necessary to take it in such beverages as tea and coffee, which are stimulants and not foods in any sense of the word.

Where does tea grow? The tea plant grows only in semi-tropical regions. China and Japan are great tea-producing countries. Tea can be grown in other sections of the southern part of the United States. But it is not cultivated to any extent in this country except near Charleston, South Carolina.

What part of the tea plant is used in making the beverage? Tea is made of the dried leaf of the tea plant. This leaf is gathered by hand and dried. It is then rolled, a process often performed by hand. So you see a good deal of hand labor is required in harvesting and preparing the tea leaves for market. For this reason the cultivation of tea can be made to pay only in those countries where labor is very cheap. The laborers on tea plantations are paid only a few cents a day. The principal reason why tea is not grown in the United States is that no laborers can be secured for such small wages

As yet no machine has been invented that will pick the perfect tea leaves and reject those

Picking tea in a Japanese tea garden

that are unfit for use. It is exactly like picking cotton, which can be done successfully only by hand because the cotton bolls do not all ripen at the same time. Each cotton field must be

gone over two or three times during the season in order to gather a full harvest. The same is true of the tea plant. The leaves cannot all be harvested at one time because they do not all reach their full growth at the same time.

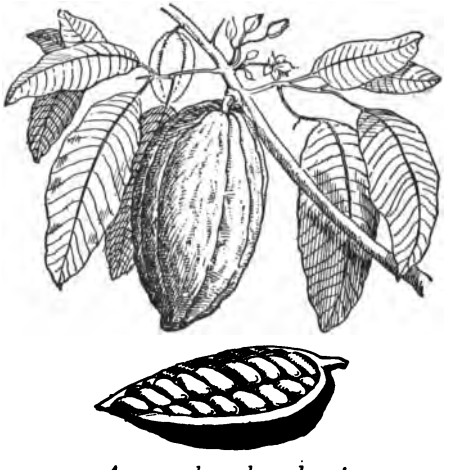
What countries drink the most tea? The great tea-drinking countries of the world are England and Russia. In these countries all who can afford to do so drink tea. The United States, Australia, and Canada also use a great deal of tea. In the United States, although tea is used extensively, it is by no means so universal a beverage as coffee. The amount of tea used annually in the United States is about one pound for each inhabitant; the amount of coffee used is ten pounds for each inhabitant.

In business offices and banks in Russia everybody is engaged at certain hours of the day in drinking tea, and the transaction of business must wait until they have finished. Tea is served in the banks about ten o'clock in the morning and at three o'clock in the afternoon. Then for ten or fifteen minutes everybody quits business and drinks tea. In England tea is not so commonly served in business places as in Russia, but it is served in that country in restaurants and private houses from four to five o'clock in the afternoon, as well as at meals.

The wide use of large quantities of coffee and

tea cannot be regarded as harmless. Extreme temperance in the use of these beverages must always be observed if health is to be maintained. As we have already said, so far as children are concerned, the drinking of tea and coffee should be entirely forbidden.

What is cocoa? Cocoa is a beverage prepared from the nuts of the cacao tree, and is very highly prized throughout the world. The cacao tree grows only in tropical regions, and for that reason all the cocoa used in this country must be imported. The nut of the cacao tree contains an alkaloid similar to that in tea and coffee, namely, *theobromine*. This name is derived from Greek words meaning "food for the gods." Cocoa also contains small quantities of caffeine. Theobromine and caffeine are closely related to each other chemically and have a similar effect on the nerves. Both are stimulants.



A cacao branch and nut

Theobromine, however, is much less stimulating than caffeine, and for that reason is regarded as much less dangerous to health.

There is a considerable amount of nourishment, especially oil, in cocoa. Cocoa has therefore a food value. But while cocoa is less objectionable than tea or coffee, it is not a good thing for children to drink. They do not need anything of this kind. Milk and water are the only beverages that should be given a child.

Cocoa is made by grinding the whole nut, with about half its oil extracted, to a fine powder, to which a certain quantity of either milk or water is added to make a suitable drink. It is used much less extensively in this country than either tea or coffee, though many prefer it to either of those drinks. While it is much milder than tea or coffee in its effect, the use of cocoa should nevertheless be guided by temperance.

What is chocolate? Chocolate is cocoa in a slightly different form. The only difference between them is that in the manufacture of chocolate no part of the oil of the nut is extracted as in the manufacture of cocoa. Hence chocolate is much more nutritious than cocoa, because of the greater amount of fat it contains. It is also less stimulating than cocoa, since it contains more oil or fat and consequently a smaller proportion of theobromine and caffeine.

Is chocolate used in other ways than as a beverage? When mixed with sugar, chocolate is extremely agreeable to the taste. For this reason a very large amount of chocolate is used in the manufacture of confectionery. Chocolate is also mixed with milk and with sugar, to make the well-known milk chocolate. For persons engaged in hard labor these sweetened chocolates are excellent foods. But they are not suitable for children to eat. They unbalance the ration and give a stimulant which the child does not need. They also give the child a taste for sweets which, if indulged, must necessarily interfere with his health and general welfare.

What are the principal varieties of soft drinks? Soft drinks consist of two general classes, those that contain sugar, bitter extracts, spices, and so on, and those that in addition to these things contain an alkaloid. There is another class commonly known as "root beers." Root beers are supposed to be made of extracts from aromatic or medicinal roots, to which is added sugar and also a yeast which produces a slight degree of fermentation. They contain little or no alcohol. There is another large class of soft drinks known as "pop."

The soft drinks to which alkaloids have been added consist almost entirely of those which contain caffeine. Caffeine, as you have already

learned, is the active principle in tea and coffee. In tea and coffee the caffeine exists naturally in combination with other elements. But in soft drinks containing caffeine we find the pure alkaloid, usually obtained from the sweepings of the tea factory or from the wastes in the manufacture of products containing caffeine. The pure alkaloid is more active, and for that reason more dangerous to health, than when combined with other elements as in tea and coffee.

A few years ago soft drinks which contained cocaine were sold. But the war against cocaine has been so vigorous that the sale of all such drinks practically has been stopped.

Ginger ale is a soft drink which contains no alcohol and no added alkaloid. It is supposed to get its pungency from the use of an extract of ginger, but quite frequently much of its pungency results from the use of extract of Capsicum or pepper.

What is the effect of soft drinks on the health of the child? Children should never be given soft drinks that contain any alkaloid, such as cocaine or caffeine. Therefore, no one should be permitted to sell children soft drinks containing these harmful drugs.

Another objection to soft drinks is that as a rule they contain large quantities of sugar. The child does not need any more sugar than

he gets naturally in such food as milk and fruits. Neither should such extracts as spices, ginger, and Capsicum have a place in the child's diet. All the sugar and condiments necessary to his welfare are supplied in the simple, wholesome food every child should eat.

What are alcoholic drinks? Beverages which contain alcohol in any quantity or form are known as alcoholic drinks. These drinks are divided into two great classes, fermented beverages and distilled beverages.

What are the chief fermented beverages? The chief fermented beverages are wine, beer, and hard cider. Wine, for instance, is made from the juice of ripe grapes that has been allowed to ferment.

What causes the fermentation? The fermentation of grape juice and other liquids containing sugar is caused by the presence of a vegetable organism which we call yeast. There are many different kinds of yeast, producing different flavors, but all of them have this property in common — they can convert sugar into alcohol and carbon dioxide. Grape juice contains from fourteen to twenty-six per cent of sugar. When the sugar in grape juice is fermented, the quantity of alcohol produced is about one half the total quantity of sugar. Thus grape juice containing fourteen per cent of sugar would make

A vineyard in the foothills

a wine containing approximately seven per cent of alcohol. The juice of apples contains from eight to sixteen per cent of sugar. If fermented it would make cider containing from four to eight per cent of alcohol. The fermented cider is called "hard cider." Grape juice and apple juice do not need the addition of any fermenting agent since yeast naturally is present in them.

What is beer? Beer is a fermented beverage made from what is called a mash, that is, a quantity of cereals and hops crushed and heated in water. Barley is the chief cereal used in

making beer. Beer made in the United States contains from less than two per cent to a little more than four per cent of alcohol.

What is ale? Ale is the same as beer except that it is made of a heavier mash and contains from five to eight per cent of alcohol. Because of the higher percentage of alcohol, ale is much more injurious than beer.

What is champagne? Champagne is a wine which is fermented in sealed bottles. It is made in a certain department or division of France only. Wine fermented in the bottle in other localities is known as sparkling wine. When the bottles containing champagne or sparkling wines are opened, gas escapes from the liquid, forming small bubbles which for a long time continue to rise to the surface.

What relation have these fermented beverages to health? For the growing child, the use of fermented beverages, even in small quantities, is very injurious to health. Alcohol is a habit-forming drug, and when once you begin to use it you are apt to like it a little better each day, and thus be inclined to take more and more of it. For this reason alcohol is a dangerous drink.

What is grape juice? Grape juice is a beverage made from the unfermented juice of grapes. The juice is heated so as to kill all the yeasts or fermenting substances in it, and is then set aside

to allow the solid matters to settle. After a few days, when the grape juice is bright and clear, it is put into bottles, sealed air-tight, and subjected for a certain length of time to a temperature under the boiling point of water. Juices put up in this way remain bright and clear, and will keep almost indefinitely until the bottle is opened.

Grape juice is not only a pleasant drink but also has food properties, due chiefly to the sugars it contains. It also has acid properties, due chiefly to the tartaric acid contained in it. These acid properties are thought to be favorable to health, not alone because of the acid, but because of the potash with which the acid is combined. Well-made and well-preserved grape juice is palatable and wholesome, and may be used occasionally by children, but only in small quantities.

What are distilled liquors? The principal distilled beverages are whisky, brandy, rum, and gin. Whisky is made from fermented cereals in the same way that beer is made, except that no hops are added. After the cereals are fully fermented the mash is put into a large copper vessel and distilled. The raw whisky produced by this process of distillation is then placed in oak barrels and stored for a number of years.

Brandy is made by distilling wine. It is

therefore an alcoholic product of the grape. Rum is distilled from fermented molasses, just

A small still for the distillation of liquors

as whisky is distilled from fermented cereals. Gin is distilled alcohol of any kind, flavored with such substances as juniper and sloe berries.

To make such liquors as cordials and cocktails, alcohol is mixed with sugar and other substances, principally flavors and colors. All such mixtures are very injurious. Some alcoholic products, like absinthe, contain substances so poisonous in nature that they produce the most dreadful effects.

Those who use alcoholic beverages are less efficient in their work, have less resistance to cold, and become fatigued more easily than those who do not use them. They are far

more likely to have a diseased liver, or tuberculosis and pneumonia. They are often shut out from useful employment, since many industries will not accept them. The Pennsylvania railroad will not employ any one who uses alcohol. Neither does it allow alcoholic beverages to be sold on its dining cars. Why should a boy form a habit which will handicap him in earning a living and also shorten his life?

Because of the harm done by alcoholic liquors, it has been made illegal to sell them as a beverage. It is illegal to carry liquors from "wet" to "dry" territory. During the war the manufacture of whisky has been forbidden.

QUESTIONS TO HELP THE PUPIL

1. What does water dissolve as it passes through the soil? 2. What is the difference between "hard" and "soft" water? 3. How can hard water be softened? 4. When do we need a greater quantity of water and when a smaller? 5. Why is it better not to drink water while eating? 6. Has sour milk any special value? 7. What is the active principle in coffee? in tea? 8. What name is given to this class of substances? 9. What is the effect of alkaloids? of tannin? 10. What stimulant is found in cocoa? 11. What is the difference between chocolate and cocoa? 12. Is chocolate good for children? 13. What are soft drinks? 14. What is the danger of soft drinks? 15. What causes fermentation? 16. Is the use of fermented or distilled beverages wise or healthful?

XII. Tobacco and Its Dangers

What is tobacco? The tobacco plant, from which various kinds of tobacco are made, grows extensively in the southern states of the Union, especially in Florida, North Carolina, Virginia, and Kentucky. The tobacco plant is also cultivated in Connecticut, Ohio, Indiana, and the southern portion of Wisconsin. The broad leaves of the plant, after the stems have been removed, are manufactured into smoking tobacco, chewing tobacco, and snuff.

What is the danger of tobacco? We have read in the preceding chapter of the dangers of drinking coffee, tea, and cocoa, because of the alkaloids they contain. Equally dangerous, if not more so, and for the same reason, is the use of tobacco. Tobacco contains an alkaloid called *nicotine*. In its pure state nicotine in small quantities will cause death. But in tobacco, as in coffee and tea, the alkaloid exists in such minute quantities that the process of poisoning goes on very gradually and the tobacco user does not feel the effects until the habit is firmly fixed and very hard to overcome.

The use of tobacco in any form is extremely injurious to the heart, the lungs, the digestive

organs, and the nerves. The heart fails to do its work as it should; its action becomes irregular and at times it misses a beat. The blood flows more sluggishly through the lungs; hence it fails to get its proper share of oxygen. Those boys who use tobacco and alcohol can often be picked out from the others, by their teachers, because of sluggishness and failure to keep up in their studies with their classmates. Even in athletics tobacco users cannot hope to excel, because of their weak muscles. When the heart fails to supply the other organs with the proper amount of blood, not only lungs, but stomach, liver, kidneys, nerves, muscles—*all* the organs—are hindered in doing their work. Even the phagocytes or cell eaters in the blood are so weakened that they cannot well guard the body against germs that injure the health.

Most boys desire to be large, well-formed, strong, active men. Such persons can accomplish more than weak, small men, other things being equal. They have more chances to be leaders among their fellows. It is right then to desire these good bodily characteristics. But the tobacco and alcohol habits, if begun during the growing period, hinder the body from reaching its full size. Tallness, the height one's stature attains, depends upon the rapid growth of the bones. Children who use these drugs

do not grow as tall, on an average, as do their companions who are free from the habit.

Often the mind also is injured. Memory is weakened and the cigarette smoker finds it difficult to fix his attention upon a hard task. He falls below his classmates in scholarship. These facts have been proved by actual tests carried out in a number of schools. Cigarette smoking is especially harmful, for the nicotine-filled smoke is drawn into the lungs where it comes into close contact with the blood. By means of the blood the poison absorbed is carried through the entire body.

Does it not seem foolish for one deliberately to use these drugs knowing the harm they do?

QUESTIONS TO HELP THE PUPIL

1. Where in the United States is the most tobacco raised? 2. What part of the plant is used in manufacturing tobacco? 3. What is the similarity between coffee and tea, and tobacco? 4. What alkaloid is contained in tobacco? 5. What is the effect on the body of nicotine in the pure state? 6. Why does not the tobacco user feel the effects of the nicotine immediately? 7. What is the effect of nicotine on the heart? 8. Why does the cigarette smoker fall an easy victim to disease? 9. What is the effect of cigarette smoking on the mind? 10. Can the cigarette smoker hope to succeed in what he undertakes? 11. Is the use of tobacco a foolish habit? why?

XIII. Confections, Sirups, and Pastry

What are candies? Candies are products made chiefly of sugar, with the addition of coloring and flavoring matters, and put up in various shapes and forms attractive to the eye. The terms "candies" and "confections" do not mean quite the same thing, although a candy is always a confection and a confection may be a candy. Confections are products which may contain fruit in addition to the elements that are used in making candies. A jam or jelly is a confection, but not a candy.

From what plants is sugar produced? The sugar we buy in the grocery store is made chiefly from two plants, the sugar cane and the sugar beet. Small quantities of sugar made from the maple tree may be found on the market, and in some parts of the world sugar is produced from other plants, for instance the sugar palm. At least four fifths, and possibly a larger proportion, of the sugar used in the United States is made from sugar cane.

Sugar cane grows luxuriantly in rich soil that has been properly tilled. It looks like corn and sorghum. It has a jointed stalk, and often grows to a great height, bearing blades at each joint. As it ripens, the sugar cane

becomes so heavy that it hardly ever stands up straight. It falls over, especially during a heavy wind, becoming a tangled mass that seemingly would make the harvester's task almost hopeless.

Sugar cane grows in a number of the southern states in our country, Louisiana leading in its production. In some seasons over three hundred thousand tons of cane sugar are made in Louisiana. Cuba, however, makes more cane sugar than any other country in the world. Its annual output of cane sugar is now about three million tons. Over five hundred thousand tons are made in the Hawaiian Islands. Porto Rico and the Philippine Islands also produce a large quantity of cane sugar. But Cuba is the principal source of that which is imported into this country.

Sugar beets grow in more northern latitudes. In this country the great beet-growing states are Michigan, Colorado, and California. The beet often contains from fourteen to eighteen per cent of sugar. It is thus richer in sugar than the sugar cane raised in this country, which usually contains only from eleven to thirteen per cent. But the sugar cane of Cuba and that of the Hawaiian Islands is often richer in sugar than are beets.

What ingredients are mixed with sugar in making candies? Usually some coloring material is

mixed with the sugar. These coloring matters are either coal-tar or vegetable dyes. Various

Pulling homemade taffy

flavoring matters, such as cinnamon, peppermint, chocolate, almond, coconut, and other substances are used also to give each kind of candy a particular flavor. It requires great skill and long practice to make attractive candies.

Can we make candy at home? One of the most enjoyable pastimes on a cold winter evening is the making of so-called "taffy." The ordinary sirup is not suitable for making high-grade taffy. You must first get a genuine sugar-cane sirup or good New Orleans molasses if you wish

to make a good first-class taffy. Then you must boil the molasses or sirup, stirring carefully so as not to let it scorch, until a spoonful dropped into cold water makes a waxy, hard mass. After that the boiling sirup is poured into greased plates and set in a cool place until it begins to harden. It is then taken out and pulled vigorously. During this process it takes in a large number of small air particles and changes in color to yellow or, when the sirup is very pure, almost to white. Such taffy is delicious from the candy eater's point of view. It is not so easy to make fancy candy at home, but candies like fudge are easily made there.

Are injurious substances used in making candy? Unfortunately, yes. Within the last few years some candies have been coated with a soluble gum in order to give them a certain gloss or finish. This coating has sometimes been found to contain arsenic, which is dangerous to the health of the consumer. The coal-tar dyes also that were formerly used were more or less poisonous. Fortunately, the food laws have practically succeeded in stopping the use of such materials. To-day a number of manufacturers use only pure vegetable substances in making candies. Moreover, their candies, which are highly attractive in color and glazing, contain no poisonous substances and are so

made that from the standpoint of purity they are perfectly safe.

Candies are also made to a considerable extent of glucose.

What is glucose? Glucose is a thick, sirupy, almost colorless product derived from the starch of Indian corn or of the potato by treating it with an acid at a high temperature. Most authorities regard glucose as harmless. However, since glucose is an unnatural sugar, that is, a sugar not made in the natural way, it may not be so wholesome as a natural sugar. It is a well-known fact that very young animals, such as mice and chickens, fed with glucose instead of ordinary sugar, do not thrive. This is true also of bees. So it appears that if children are to eat candy at all—and it is best for them not to do so—those candies will do least harm which contain no glucose.

What effect has the eating of candy on the health of the child? The ingredients themselves that are used in making candy may be regarded as harmless. That is, there is in them no special danger. Sugar, chocolate, spices such as cinnamon and peppermint, honey, butter, and such substances cannot be regarded as harmful. Aside from the nature of the ingredients it contains, it cannot be too strongly emphasized that candy is not a suitable food for children.

It contains practically no material which will build or restore tissue, but consists essentially of sugar, which produces only fat, heat, and energy. Hence children who eat large quantities of candy unbalance their ration because they have no appetite for proper food. As a consequence the bones and teeth are not well nourished, the muscular tissues of the body suffer from hunger, and the work that food in general is supposed to do is not done. Unfortunately, candy is eaten chiefly between meals and that is an additional danger to health.

If older children engaged in active exercise and hard work wish to eat candy, they can get a good deal of strength and energy out of it, and it will thus be of use to them. But as a food for young children candy must always be considered dangerous.

Grown people who are active and get much physical exercise may eat well-made candy in moderation without injury.

What is the effect of candy upon the teeth? It is generally admitted by everybody that children who eat a great deal of candy have poor teeth. The real danger to good health in eating candy is that the child is deprived of those elements which are needed for building bone and teeth. If there is not enough of these elements in the blood nature robs the teeth to strengthen the

bones, and thus in early childhood the teeth are poor. Even the first set of teeth may be soft and prone to decay, and such premature decay threatens not only the tooth attacked but the permanent tooth that is to come after. Hence during the teething period, which lasts up to the age of ten or twelve, the child should not be given sweets—that is, candy—in any quantity. If the child never acquires a "sweet tooth," as it is called, he will not cry for sweets. He will be content to eat the foods in which nature has provided for him all the sugar he needs. Candy, therefore, in any form or shape, is injurious to the teeth and should never be given to young or growing children.

A bad set of teeth. "Not healthful nor pretty"

What is meant by the word "sirup"? The term "sirup" properly applied means a product consisting chiefly of sugar and made by the evaporation of the sap or juice of a sugar-producing plant until it becomes a thick and somewhat sticky fluid. The sirups most commonly in use in the United States are made from the

sap of the maple tree, sorghum, or sugar cane. These products are called maple sirup, sorghum sirup, and cane sirup. The sap of the sugar beet, although it carries a large quantity of sugar, does not make a good-tasting sirup because of the large quantity of mineral salts, mostly potash, soda and lime, contained in it. When this sap is evaporated until it forms a thick sirup it tastes bitter or salty and is not commonly used for food.

Are sirups always made in the ways described? Unfortunately, most of the sirups on the market in our country are not made like the pure products described above.

In making manufactured sirups, small quantities of these excellent products, maple sirup, sorghum sirup, and cane sirup, are used simply to flavor large quantities of glucose.

How is glucose used in sirup? We have already learned how glucose is used in the manufacture of some kinds of candy. Glucose is faintly sweet, but is otherwise flavorless, and is not pleasing enough to the taste to be eaten alone. When mixed with one of the sirups mentioned it acquires the character and flavor of the particular sirup to which it is added. It thins the sirup, increases its bulk, lightens its color, and makes an attractive product which is used extensively throughout the

country. Melted brown sugar is also used as a sirup. It is often mixed with glucose, or with some of the genuine sirups that have already been mentioned.

The containers in which these glucose sirups are sold are not always correctly labeled, and when you go to the grocery store and simply ask for a sirup, the chances are you will get neither maple, sorghum, nor cane sirup, but such a mixture as we have described.

What is the food value of a sirup? A pure sirup or a manufactured sirup depends for its chief food value on the sugar or sugars which it contains. All sugars have practically the same food value. They are burned in the body completely when it is in a state of health, and furnish heat and energy.

Do sirups have any other value? The pure sirups contain mineral substances which are also useful to the body. All natural sirups — maple, sorghum, and cane — contain from two to three per cent of mineral substances, which are valuable aids to digestion and promote health. These substances, such as lime, phosphorus, soda, and potash, are useful in building bone and teeth and other tissues of the body and in producing the alkaline element in the blood which is needed to help the heart and other organs do their work. So it is plainly to be

seen that if one desires to eat sugar it is best in the form of natural sirups, because of the mineral nutrition which they give. Candies made from these sirups are to be preferred to all others. Even children might be permitted the moderate use of candies made from pure maple, sorghum, or cane sirup, provided the habit of eating sweets does not become so strong that they crave larger quantities than are good for them.

How does sirup affect the health? Natural sirups are wholesome when not eaten in too great quantities. When any one engages in active play or manual labor these sirups may be eaten without fear of injurious results. But if these sirups are eaten alone they unbalance the ration; that, is they provide too much sugar properly to nourish the body. Sirups may therefore be eaten with advantage with cakes made out of cereals rich in protein, and especially if butter is also used on the cakes. We then have a more or less well balanced ration. The butter furnishes the fat, the cereals furnish the starch, the protein, and a part of the mineral matter, and the sirup furnishes the sugar and also a considerable quantity of mineral matter.

The sirups made out of glucose contain almost no mineral matter except common salt. Salt is a wholesome and necessary ingredient of our

food, and hence is not objectionable in the quantities in which it is present in glucose. Nevertheless we can get plenty of salt from other kinds of foods, and it should not be necessary to eat glucose in order to get it.

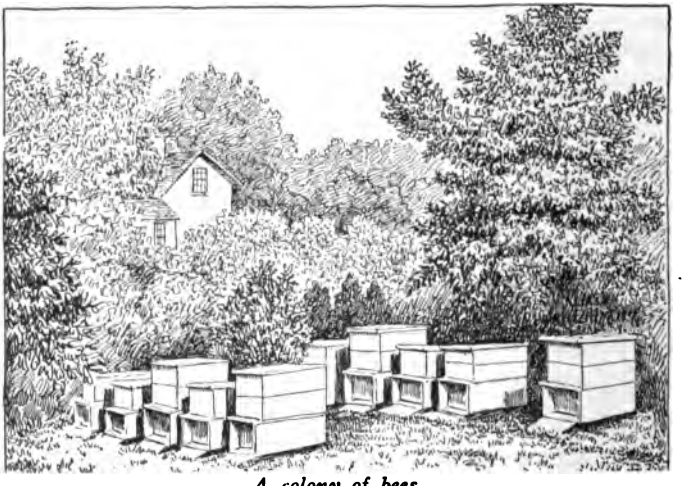
What is honey? All plants produce more or less sugar during their growth. Some are known particularly as sugar-producing plants because of the large quantity of sugar they contain. Among these are the maple tree, the sugar palm, sorghum, sugar cane, and many varieties of beets and other garden vegetables, such as sweet corn, melons, fruits, and grapes.

At the time of flowering almost all plants give out a large quantity of sugar in connection with the bloom. The sugar, or *nectar* as it is called, attracts the visits of bees and other insects that gather honey for food.

The honey we eat is gathered by an insect known as the honey bee. Many thousands of these bees live in one family or colony. During the flowering season they go long distances and bring back little stores of sugar for the common storehouse of the family. They build little five-sided houses or rooms, usually in hollow trees or in hives, and fill them with this honey after it has passed through their bodies. The bees also secrete a peculiar form of acid, called *formic* acid from the Latin word for

ant. A little of this acid is imparted to the honey, and helps to give it its peculiar and distinctive flavor.

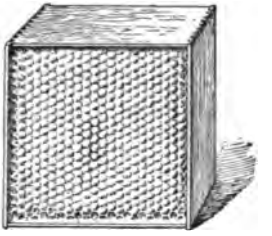
There are very few people who do not like honey. It is used exactly as sirup is used, by spreading it on bread or cakes or in making sweet cakes. Bee keeping is carried on in all parts of the country. Large quantities of honey are produced, especially in California, where the bees gather their honey largely from the wild sage of the deserts and from the flowers of the many fruit trees.



A colony of bees

What is the food value of honey? As a food, honey depends for its value on the sugar it contains. Therefore it unbalances the ration

and should be eaten in moderation, especially by children. Honey contains very little mineral matter, the sugar gathered by bees being remarkably pure. So honey is not so well adapted to promote the growth of the body as the natural sirups. But for grown persons who do hard work honey is an excellent food, as it furnishes a large amount of heat and energy.



A comb of honey

Does the eating of honey affect the health? Pure honey, eaten in small quantities, cannot be regarded as harmful or injurious to health. But sometimes the bees gather poisonous substances, or introduce poisonous matter into honey, and there are cases on record of severe poisoning due to the eating of it. For this reason it is always advisable to eat honey temperately, for even good honey if eaten in too large quantities may cause severe illness.

The taste of honey is so attractive that it is difficult to control the appetite for it. For this reason, when children eat honey the quantity they are allowed to have should be measured out by their parents and no more should be given, even if the children cry for it. Otherwise the results from eating honey may be serious.

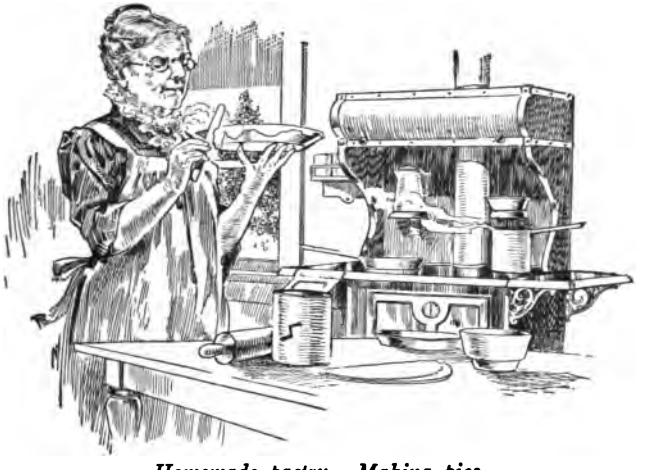
What is pastry? The term "pastry" is the name given to such foods as pies, patties, and tarts. First a holder or container is made from a dough of wheat flour to which a large amount of fat, or shortening, has been added. This holder or container is then filled with fruits, meats, or other materials, and baked.

Pastry is served at the end of the meal, as dessert. Usually when we come to pastry we have already had enough to satisfy our hunger. So the pastry we eat is only an added burden to digestion, which is really the chief objection to its use. But, if we stop eating while still a little hungry, and then have the pastry, there is no great objection to a moderate use of such food. This is especially true of fruit pies.

In England by the term "pie" is usually meant only pastry in which the filling consists of meat. In this country the term "pie" is used no matter what the filling may be. In fact, most of our pies are made with vegetable, fruit, or custard filling, a very small proportion only being made with meat filling. Even mince pie, which is supposed to contain meat, generally contains very little of it, especially if not made at home. The filling is principally made up of fruits, raisins, sugar, and spices.

The fillings used in pies made in this country are chiefly apple, peach, cherry, blackberry,

raspberry, pumpkin, custard, lemon, and mincemeat. Strawberries and some other fruits are



Homemade pastry. Making pies

often served in a kind of pie known as shortcake, in which the crust and the fruit are placed in successive layers.

Are pies digestible? Fat and flour are blended so closely in the piecrust as to interfere to a certain extent with the digestion of each. Protein, which is contained in the flour, is digested largely in the stomach, while fat, of which the piecrust contains a great deal, is digested largely in the small intestine. The starch found in the flour may be digested partly in the mouth and partly in the small intestine. Thus, when the fat is thoroughly mixed with these substances

as it is in piecrust, the protein and the starch are prevented from being acted upon by the digesting agents in the mouth and stomach which carry on the digestion of such foods. In the same way the particles of fat may be carried into the small intestine so closely intermingled with undigested protein or starch as to cause difficulty or delay in the digestion of the fat. So pastry, although it may be highly nutritious, cannot be recommended as an easily digested food. It should be eaten in moderation, and if one has already had food enough to satisfy hunger when the pastry is served, then it should not be eaten at all.

To avoid overeating it has been suggested that pastry should be served at the beginning of a meal. But this suggestion is hardly acceptable. The principal object of eating is to nourish the body. Hence, in the order of eating, those foods which are known to be best suited for the nourishment of the body should be given the preference. The best plan seems to be not to serve pastry at all, or at least to give it in smaller portions, especially to children. The growing child should eat very little of it; while the hard-working grown person may eat it more freely.

What is ice cream? It is difficult to define a product that is made in so many different ways

and out of so many different materials. But an ice cream that is properly called ice cream and is made out of the right kind of materials can easily be defined. Such ice cream is a

Freezing ice cream at home

product made by mixing with cream the proper amount of sugar and harmless flavoring matter and then freezing the mixture.

What is the food value of ice cream? The food value of ice cream is high. The cream itself contains butterfat, milk sugar, and nitrogen (protein), the percentage of fat being very high. In standard cream the content of fat is never less than eighteen per cent. To this cream is added a certain amount of sugar, a food which furnishes large quantities of heat and energy. Ice cream contains only very little protein and mineral salt (potash, phosphoric acid, lime). Thus it is a

food which furnishes great quantities of fat, heat, and energy, and is well suited for grown people who take a good deal of physical exercise. But it is not well suited to the nourishment of growing children since it unbalances the ration. It may be eaten by children in very small quantities only, if injury to health is to be avoided. It should not be eaten at all by children under five years of age.

QUESTIONS TO HELP THE PUPIL

1. What is candy? 2. From what plant products is sugar chiefly manufactured? 3. What does sugar cane look like? 4. Where is most of the cane sugar made? 5. Name a great beet-growing state. 6. May candy be made at home? 7. Are injurious substances sometimes used in making candy? 8. What law has succeeded in stopping this? 9. Is glucose a healthful substance to use in making candy? 10. Is a little candy harmful to grown people? 11. Why is candy not good for children? 12. What effect has it on the teeth? 13. What is sirup? From what plants is it made? 14. What sirup is made from the sap of a tree? 15. Does the use of sirups unbalance the proportion of food elements necessary for proper nourishment? why? 16. What beneficial substances do pure sirups contain? 17. Why are sirups good for people who work hard? 18. What kind of a ration do we get if we eat sirup and butter with cakes made of cereals? 19. Are glucose sirups to be regarded as wholesome? 20. What is honey? 21. Where do bees get the sugar or nectar? 22. Why should honey be eaten in moderation? 23. What is pastry? 24. What is the chief objection to pastry? 25. Name some fillings that are used in pies. 26. Why is piecrust difficult to digest? 27. What are the proper ingredients of ice cream? 28. For what class of people is ice cream a good food?

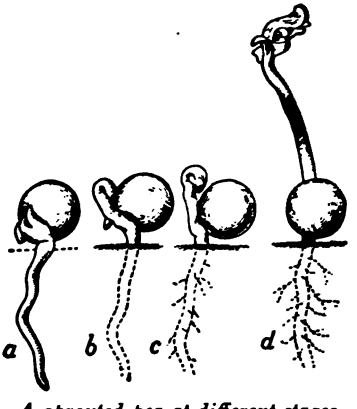
XIV. The Food Plants and How They Grow

How do plants grow? We have learned that the human body needs five principal elements of nourishment,—carbohydrates (starch and sugar), protein, minerals, fats, and vitamines. These important foods and food aids, we are told, make their home largely in fruits, cereals, vegetables, and other forms of plant life. But how do these elements find their way into the plants? Are they absorbed into the body of the plant from the soil and the air? Do they grow within the plant? To be able to answer these questions we must understand clearly how plants grow and what substances they gather from the soil, water, and air to promote their own growth.

We know that every new plant must grow from a seed. Parts of an old plant may be put into the ground where they will strike root and grow. But these are not really new plants. They are simply parts of the old plant structure.

The seed of all plants contains what is called a germ. This germ is the beginning of the life of the plant. The germ is placed within the seed, where it has access to the sugar, starch, protein, minerals, and oil which we have learned

are stored in the seeds as well as in other parts of plants. When the seed lies in the ground and the rains moisten it and the warmth of the spring days favors it, the germ begins to grow. It sends out a tiny stem that seeks the light and grows upward. It also sends out a root that loves the darkness and grows down deeper into the ground.



A sprouted pea at different stages of growth

a, April 25; *b*, April 27; *c*, April 28; *d*, May 1

What is the first food of the young plant? The food used by the plant when the seed first begins to grow can come only from the seed itself. It is composed of the sugar, starch, protein, oils, food aids (vitamines), and minerals in the seed. So we see that the young plant lives on exactly the same food elements that human beings do.

After the food elements in the seed have all been used where does the plant get its food? The plant then gets its food from the air and the soil. But we must not think that the food elements, protein, sugar, starch, oil, and minerals, are in the air and soil ready for the plants to use. The

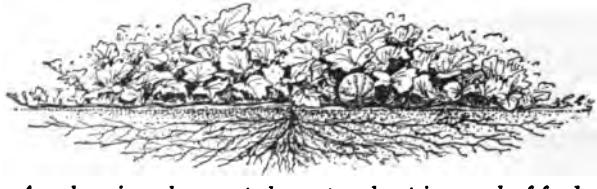
plant must make these foods for itself (except minerals) out of certain materials that it draws from the air and the soil.

We have seen how the young plant finds the food elements in the seed ready for use. With this food the plant forms rootlets that enter the soil and a stem that reaches the air above the ground. It can then begin to draw more food from the air and the soil. The young rootlets are all provided with small openings or pores. These absorb the moisture in the soil. When you dig in the ground you can see that it is moist though you cannot always see the water. The water exists in the soil in the form of fine films or thin coatings which surround the tiny particles of earth. If there were no water in the soil, the plant foods that are found there would not be dissolved and the plant could get no nourishment. Thus we see that the plant receives from the soil, in tiny particles of water that we cannot see without the aid of a microscope, the food necessary for its existence.

What is the cause of the young plant changing its method of growth? The germ in the seed has no green-colored cells (*chlorophyl*). It therefore cannot change inorganic foods (nitrogen, carbon, oxygen, hydrogen, sulphur, lime, phosphorus, etc.) into organic bodies (starch, protein, oil, etc.). This change is accomplished

by the chlorophyl cell. Hence as soon as plants have green leaves, they are independent of the food stored in the seed.

Does the food come to the root or does the root go to the food? The root goes to the food and, also, the plant food dissolved in the soil moisture goes to the root. The moisture in the ground is always moving very slowly, usually to the surface except during heavy rains. This movement of the moisture brings some



A melon vine whose roots have spread out in search of food

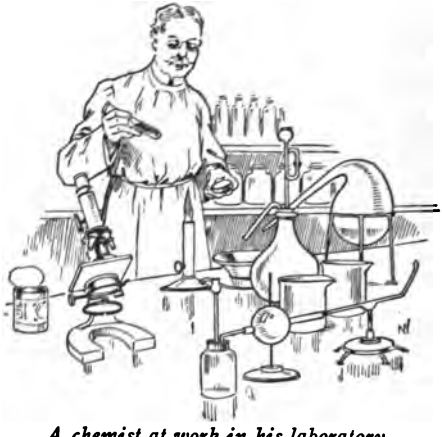
nourishment to the roots. But the plant is not satisfied with this. It sends its roots out after the food. The root system of a plant is usually quite as extensive as its leaf system. The roots of plants often run to great distances. Some of them grow deep into the earth, and others spread sidewise to great distances near the surface. Alfalfa roots have been known to extend from ten to twenty feet down into the soil, and the roots of melons and similar vines often spread out in every direction under the surface as far as the vines do above them.

Does the plant get the materials needed for its growth from the soil alone? No, the plant gets from the air much more of the materials needed for its existence than it does from the soil. From the soil the plant draws mineral matters dissolved in water. These elements form only two or three per cent of the plant growth. The great bulk of the plant, its fiber or woody matter and the sugar or starch it contains, is not drawn from the soil as many persons think. All these materials are manufactured by the plant from substances taken from the air.

The principal material the plant draws from the air is the gas, carbon dioxide. We have learned that this gas (Book I, pages 91–92) is formed by burning (combustion). Living beings (animals) breathe out carbon dioxide formed by combustion in the body. This gas is absorbed by the plants and, together with the water which the roots draw from the soil, is used in the manufacture of carbohydrates (sugar and starch). Carbon dioxide is composed of carbon and oxygen (Book I, page 11). Water is composed of hydrogen and oxygen. The combination, as we can see, would consist of carbon, and hydrogen and oxygen in the proportions in which they exist in water. These are the elements of which sugar, starch, and wood fiber are composed. While all these bodies

have the same percentage composition, there are great differences among them in internal structure. Thus we see that by combining carbon dioxide drawn from the air and water taken from the soil or air, Nature produces sugar, starch, and wood fiber, materials which make up the great bulk of every growing plant.

How do the plants combine these materials to make sugar, starch, and wood fiber? No one knows the exact method Nature uses to make these foods. It is known that Nature has provided all plants with laboratories (chemists' workshops). But so minute are these laboratories that it requires a microscope to see them. In every plant are numberless millions of these tiny laboratories. They are found principally in the leaves of green plants and it is there that the wonderful work is carried on. These laboratories are minute cells or corpuscles colored with a green substance called *chlorophyl.* But



A chemist at work in his laboratory

the work of these cells could not be carried on without the help of the light and heat of the sun. With heat and certain colors which the chlorophyl separates from the sunlight, the cells manufacture sugar, starch, and the wood fiber of the plant. Oil and protein are manufactured in a similar manner, but protein requires sulphur in addition.

The work of these cells may be compared with the work of our digestive systems. It is even more wonderful. Our digestive systems are provided with the food elements already made. But the chlorophyl cells must first manufacture these same food elements, before the plant can secure its nourishment. Thus we see that no chemist has ever lived, no matter how skilled, who has been able to approach Nature in creative genius.

What is the function of the minerals which the plant draws from the soil? The principal minerals which the plant draws from the soil are lime, potash, sulphur, and phosphorus. In addition to these elements the plants also take up from the soil magnesia, iron, silica, and many other matters that can be dissolved, with which the rootlets come in contact. The work of these minerals is to keep the sap of the plant in motion and, in some mysterious way, to control the action of the chlorophyl cells. In

some plants the minerals are found in large quantities, in others in small quantities (page 23).

We have seen how the chlorophyl cells, stimulated by the minerals that the plant draws from the soil, manufacture the food elements,—starch, sugar, oil, protein, and wood fiber. All these foods are manufactured in solution and so are carried to every part of the plant where they are used in growth. The wood fiber is deposited chiefly in the trunk, the branches, and the leaves. The sugar is distributed throughout the plant. In some plants it is found chiefly in the sap, as in the sugar cane or the maple tree. In other plants, as in the sugar beet and many other root crops, it is stored chiefly in the roots. The starch is stored in all parts of the plant, to be changed to sugar or other soluble form later when it is needed for the plant growth. Starch is found chiefly in the seeds of cereals and in certain tubers (potato, cassava, etc.).

How are proteins and oils formed in the plant? The manufacture of protein and oil in plants is not so well understood as the formation of sugar and starch. We have learned (page 21) that one of the distinctive elements of protein is nitrogen. It is known that for the manufacture of protein the plant draws nitrogen in the form

of nitric acid (nitrates) from the soil. Some plants (clover, peanuts) also draw nitrogen directly from the air. It is quite probable that the same cells which are active in the production of sugar and starch also take the more important part in the manufacture of proteins. Oils are formed of essentially the same elements as the carbohydrates and it is thought they are formed in some way from the carbohydrates.

The proteins are stored in all parts of the plant but particularly in the seed. Oats, wheat, peas, and beans are examples of seeds that contain large quantities of protein. Oils are also found stored particularly in the seed. Cotton seed and all nuts contain large quantities of oil. Some fruits, too, like the olive, are particularly rich in oil.

The starch, the wood fiber, the sugar, the protein, and the oil formed by the digestive function of the plant cells make up from ninety-five to ninety-seven per cent of the average dry weight of the plant. The quantity of mineral which the plant takes from the soil is therefore very small in comparison with the total weight of the plant.

Do all plants manufacture the food elements needed for their growth? Plants do not all make their own food in the way which has been described. Some plants attach themselves to

others and draw from their tissues the stored-up food they need. Such plants are called *parasitic* plants (orchids, mistletoe). Other rare plants, such as the Venus flytrap and the pitcher plant, are known to catch living insects in their leaves or flowers, kill them, and absorb the food elements of which they are composed. Others (mushrooms) of the class called fungi, having no green cells, live on dead and decaying animal substances in the soil, thus getting their food elements ready made. But such plants are of little importance to us, for few of them are used as food by man.

Plants which catch living insects for food
A, Venus's flytrap; *a*, insect caught; *B*, pitcher plant; *b*, "pitcher" cut through center

Can all plants be used as food for man? All plants cannot be used as food for man. Many draw substances from the soil, or manufacture them (nux vomica, bitter almonds, some mushrooms), which poison us. Others contain so little of the nourishing elements that they are

useless as food. Food plants, therefore, are those plants that do not contain injurious substances, but do possess food elements in such quantities as to make them of value as nutriment.

An edible mushroom

Does the food plant in growing exhaust the soil? The manufacture of protein by the plant undoubtedly makes large demands on the nitric acid contained in the soil. On the other hand, the carbohydrates and oils are formed entirely of materials drawn from the air. The plant, it is true, draws water from the soil, but the water cannot be regarded as a constituent of the soil itself. The soil also furnishes the mineral ingredients that help the chlorophyl cells in their work of forming the food elements. Without these minerals it would be impossible for the plant to produce any of the substances of which the plant is composed. For the most part the minerals thus used are phosphorus, lime, potash, iron, and magnesia.

Some plants make larger demands upon the soil than others do. Some require greater quantities of nitric acid. Others need more phosphoric acid; still others, more potash. This is

why crops are changed from season to season by a process called *rotation of crops*. But rotation of crops is not enough. It is also necessary to restore to the soil certain minerals which plants continually draw from it. If this were not done the crops would draw so much of these substances from the ground that after a number of years there would not be enough to nourish the plants properly. Among the substances which farmers need to add to the soil are nitrogen, potash, lime, and phosphorus.

What are fertilizers? Those substances named above are called *fertilizers*. They are found in deposits in various parts of the earth. Vast quantities of these natural deposits exist, enough for thousands of years to come. In other ways Nature provides that the materials stored in the soil shall not be entirely exhausted. So we may be sure that as long as the world exists and we know how to use its resources, the soil will always produce food.

What are manures? Manures are fertilizers made on the farm. The wastes of all farm animals, the sewage of cities, and the crops that are grown to be plowed into the soil are the principal manures. These bodies contain large quantities of organic matters which, when they decay in the soil, form a dark-colored mold called *humus*. Humus is very beneficial

in increasing the fertility of a soil. It makes the soil more porous and retentive of moisture. The good farmer carefully conserves all the manure and does all he can to increase its quantity. The keeping of dairy cows gives large quantities of the best manure.

What is the value of lime? Lime, in addition to being a necessary ingredient of plants, has a high value in improving the texture of the soil. It also prevents the soil from becoming acid, which it does by reason of the withdrawal of lime and potash by the crops and the development of carbonic and other acids due to the decay of organic substances. Certain very important crops, such as alfalfa and clover, do not grow well in an acid soil, but do flourish after the soil has been treated with lime. Quicklime is the lime as it comes from the kiln. The carbonate of lime (limestone) when burned loses its carbonic acid and becomes very caustic (burning). In this state it decomposes (burns up) flesh and vegetable matter very rapidly. It should not be used on land to which manure has been applied. Such land should be dressed with limestone ground to a powder so fine that the particles cannot be felt. Such a powder is called *impalpable.* The good farmer always tests his soil, and if at any time it is found to be acid he uses plenty of lime.

Where is potash found? Nearly all the potash mines are in Germany. They occur deep under the surface and over a wide area near the city of Stassfurt. These mines practically supply the potash of the whole world. Potash also exists in large quantities in wood ashes. That is one reason why ashes are regarded as a fine fertilizer. They also contain lime and phosphoric acid. Seaweed (kelp) also is rich in potash. Such crops as potatoes and tobacco require large quantities of potash. It is a pity to waste potash in growing so useless a crop as tobacco.

Where is nitrogen stored? The chief deposits of nitrogen are found in Chili. It is combined as nitric acid with soda and is known as Chili saltpeter. Vast quantities of this salt are shipped to all parts of the world and used as a fertilizer, and in the manufacture of nitric acid and explosives.

Where is phosphorus stored? Deposits of phosphates (phosphoric acid combined with lime) are found in many parts of the world. Perhaps the largest deposits are found in this country. They are very extensive in South Carolina, Florida, and Tennessee. The phosphates are ground into a very fine (impalpable) powder and may be used in this condition on acid lands. Usually the powdered phosphate is treated with

sulphuric acid (oil of vitriol) which renders the phosphate soluble. It is used chiefly in this condition as a fertilizer and is known as acid phosphate. Bones are also valuable sources of phosphates. They also contain large quantities of nitrogen in the form of protein. When you burn bone the protein is destroyed. When you put a bone in hydrochloric acid the phosphate of lime is dissolved. Though the bone retains its form it may easily be bent.

QUESTIONS TO HELP THE PUPIL

1. Name the five food elements that the body needs. 2. In what kinds of plants are they found? 3. How do plants get them? 4. Explain how the plant develops from the seed. 5. What food elements does the young plant live on? 6. How does the food of the young seedling differ from that of the same plant after it has a stem and plenty of roots? 7. In what form does water exist in the soil? 8. Why is it necessary to have water in the soil? 9. Why does the plant change from one manner of getting its food to another? 10. How does the moisture in the soil reach the roots of the plant? 11. Describe how the root goes after its food. 12. Which gives most food to the plant, soil or air? 13. What sort of food does the plant get from the soil? 14. What sort of food does the plant get from the air? 15. Explain how the chlorophyl cells work. 16. How do the minerals help the plant? 17. What minerals are needed by plants? 18. How are sugar, starch, wood fiber, protein, and oil manufactured by the plant? 19. In what parts of the plant would you look to find them? 20. What are parasitic plants and why are they so called? 21. How does the pitcher plant obtain its food? 22. On what kind of food does the mushroom live? 23. Name some plants that are not food plants. 24. What

is meant by rotation of crops and why is it used? 25. Why are fertilizers and manures needed on soils where crops are grown? 26. Name some important fertilizers. 27. Explain the use of lime. 28. Where do farmers get lime, potash, nitrogen, and phosphorus?

XV. Buying and Caring for Foods

May we judge the nourishing value of foods by their cost in money? The nourishing value of foods cannot be judged by their cost. Oysters, butter, cheese, and choice cuts of meat do not give more nourishment than foods that cost far less. Indeed, some expensive foods do not have nearly as much nourishing value as the cheaper articles. Low-grade flours are often more nourishing and always more wholesome than the finer white flours. So we see the great importance of knowing the cost and the comparative nourishing value of different foods. It means a great deal to our pocketbooks as well as to our health. The careful housekeeper chooses foods that are the most wholesome and nourishing and these at the same time are often the cheapest.

Is meat very nourishing? There are other foods that contain much more nourishment. It is not at all necessary, as some persons think, to eat meat every day. A pound of dried beans, for example, contains as much protein as a pound of roast beef. Besides protein, the pound of beans also contains fifty per cent of sugar, starch, and fiber. It is inferior to the beef only in its content of fat. At the same

time, the pound of beans costs far less than the pound of beef.

Why spend money for meat? Since meat is considered a normal food for man (page 73) and contains food properties which make it useful in moderate quantities, it may be well for us to eat a little of it occasionally. But in buying it, the housekeeper should remember that the cheaper cuts furnish just as much body-building material as the more expensive, and in some instances more. If it is cooked slowly and for many hours in a fireless cooker, even very tough meat from the cheap cuts becomes tender and pleasing in flavor.

Prices of foods vary considerably. In years of poor harvest, and in times of war, certain foods, usually cheap, like cereals, potatoes, peas, and beans, rise in price. But the situation is, as a rule, only for the time being. Under normal conditions the housewife who knows food values is able to provide her family with all the nourishment they need without paying high prices for eatables with fancy names and a fine appearance. It is true that expensive foods often tickle the palate with rare flavors—which is usually a reason for the high prices charged. But a good cook can prepare the simpler, less expensive foods so that they are palatable and pleasing in flavor.

In eating many of the expensive foods, there is also the danger of getting an oversupply of one kind of body-building material and not enough of another. The expensive foods are generally the "rich" foods. They contain much sugar or starch, or fat, or protein. Therefore they are not well balanced and do not meet the need of the body for all the food elements and all in correct proportions.

What is quality in foods? There are other conditions besides price that the housewife must consider in buying foods. She must make certain that the foods sold to her are fresh and wholesome. In the United States the national pure food law was intended to protect the public from bad and misbranded foods. This law requires the manufacturers of foodstuffs to state the truth on the labels but it does not require a statement of all the ingredients their goods contain. If they comply with the law, the housekeeper, by reading the labels, is able to avoid foods that contain harmful preservatives or poisonous coloring matters (pages 13, 62). But not all manufacturers label their products correctly. To protect the public from these lawbreakers, food inspectors visit markets and storage plants and analyze samples of different foods to discover whether any contain dangerous substances. Every year large quantities of

foodstuffs are found unfit for use and are destroyed by them.

In most large cities a chemist is employed by the health department. When any one suspects that a food contains impurities or is not what it is represented to be, he may call the attention of a food inspector to the matter. The states also have food laws and food inspectors. But unfortunately, state, municipal, and national inspectors are not always as careful as they should be.

When foods are kept a long time they have a tendency to deteriorate or to become less wholesome. When meats decay, for instance, poisons form in them, due to the action of bacteria. The poison in decaying meats is called *ptomaine*. We frequently hear of persons who become ill from ptomaine poisoning. The storage of food for proper periods, at a low temperature, is a very useful practice, but in some cases merchants have stored meat, eggs, or fish that had begun to decay before they were put into storage. Sometimes carelessness in preparing the foods for canning will result in bad quality. One of the best ways of preserving foods is to sterilize them with heat and seal air tight. This is called canning. Foods are preserved also by drying, which is done either by the heat of the sun or by artificial heat.

What dangers arise from careless handling of foods? We have all seen foodstuffs, especially fruits and vegetables, without covering of any kind to protect them from dust, piled high on the sidewalks in front of stores. Such foods are sure to swarm with germs of all kinds. Flies crawl over them, leaving a trail of dangerous bacteria behind. They are handled by persons who may have disease germs on their hands. The wise housekeeper who is careful of her family's health will refuse to buy foods displayed in this way.

A sidewalk display of fruits and vegetables. The foods are sure to swarm with germs

Most dealers and manufacturers have learned the value of cleanliness in preparing and handling their goods. They have found it better for their business. The careful dealer, who keeps his goods well protected from dust and dirt, does not want for customers. The careful manufacturer of to-day

prepares his food products in such a way that human hands do not come in contact with them until they reach the consumer's table. Meats, especially in summer, should be exposed for sale in iceboxes with glass doors.

What precautions must the housekeeper take after the food is bought? When the housekeeper has bought fresh, wholesome food at a clean and sanitary store, her responsibility is not yet ended. If she fails to care for it properly after it is bought, it will soon spoil. Her best aid in keeping food fresh is the refrigerator or icebox. Bacteria that cause decay grow best in a warm temperature. So if foods are left in a warm kitchen, these bacteria multiply very rapidly. Such foods as meats, fish, vegetables, fruits, milk, butter, and eggs should be placed in the refrigerator as soon as they are brought into the house.

Why should fruits and vegetables be washed? Fruits and vegetables should be thoroughly washed before they are served. Though the dealer may have been careful in handling them, they may be covered with bacteria from the hands of the pickers or from the soil in which they grew. Particularly should vegetables like lettuce, celery, and cabbage, which are eaten raw, be well washed, for bacteria can easily cling to the leaves. Cases of typhoid have sometimes

been traced to the eating of unwashed vegetables or fruits. It is best to take every precaution and wash even vegetables that are to be cooked, although all bacteria are killed by heat.

Housewife washing lettuce

What is the cheapest food? Among foods, cereals (wheat, corn, oats, barley, rice, and rye) are the most important. Based on the actual nutriment contained, they are usually the cheapest foods. Among cereals Indian corn (maize) is the cheapest. One pound of whole corn meal will furnish nearly enough food for a small man of inactive (still, sitting down) habits for a day. Even at the present high price of corn (spring of 1917) this costs only five cents. Persons with small means would do well to buy whole corn meal. If refined in milling, as is usually the practice to-day, it loses much of its most valuable qualities. If a child eats corn meal or other cereal for his principal diet, he should have at least one pint (pound) of milk a day.

He could live indefinitely on this diet, grow, and reach maturity. But it is not advisable to confine any one to a monodiet (consisting of but one kind of food).

What is food adulteration? The adulteration of food is accomplished in several ways. Some valuable ingredient may be extracted, as cream from milk. Some cheaper ingredient may be added, as corn meal to wheat flour. It may be packed in a way to deceive, as in placing the big apples or berries on top. It may be colored to deceive, as in adding a red color to tomatoes. It may have some injurious ingredient added to it, as in using borax or benzoate of soda as a food preservative. Besides being adulterated, it may be decayed, as meat that is spoiled or flour that is musty. It may be filthy, as when it has been exposed to flies and dust. In some or all of these ways foods may be adulterated.

Food adulteration is a very dishonest practice. It threatens both the health and the pocketbook of the consumer. It tends to bring about individual and national inefficiency.

What is misbranding? Misbranding of food products consists in labeling them so as to deceive the consumer in regard to their origin, kind, and quality. If a food produced in America is represented as a foreign product, it is misbranded, as when cheese made in this

country is called Camembert, or olive oil produced in California is called Lucca. If a food product is called highest quality when it is not, as select oysters when they are only common ones, it is misbranded. It is a misbranding to call a mixture of flour and bran graham, for that name signifies a natural whole ground wheat flour.

The object of adulteration and misbranding is to get for food products of an inferior grade a higher price than they are worth. Both adulteration and misbranding are still practiced to some extent, owing to the inadequacy of the laws and the negligence or indifference of a few food officials.

QUESTIONS TO HELP THE PUPIL

1. Is the housewife wise or unwise, when she pays a high price for foods in the belief that in so doing she is buying more nourishment? 2. Give reasons for your answer. 3. Name other foods that are as nourishing as meat. 4. How should the cheaper cuts of meat be cooked? 5. What is the danger in eating much expensive food? 6. Name some things that cause the prices of foods to vary. 7. Name several things that the careful housewife must consider if she wishes to buy foods of excellent quality. 8. What officers are employed by the city or state to help her? 9. What is the national pure food law? 10. What is ptomaine? 11. How can ptomaine poisoning be avoided? 12. How may foods be preserved? 13. What danger is there in displaying uncovered food on the sidewalks in front of stores? 14. How does the careful dealer handle his goods? 15. How can the housewife prevent her food from spoiling? 16. What care

should be taken in washing fruits and vegetables? 17. Name some ways of economizing in the buying of foods. 18. What is the cheapest food? 19. What would make a cheap, well-balanced diet for a child? 20. Explain the difference in the meaning of the words *adulteration* and *misbranding*. 21. Name some ways of adulterating food. 22. How could a food be misbranded? 23. Why are these practices harmful? 24. What is the object of adulterating and misbranding?

XVI. Health Habits

What have we learned about food and drink? We have learned that food, like air, is necessary to life. Without food we should soon starve to death. Neither could we live without drink. In fact, we could not live as long without water as we could without food. We have read of the bleaching bones half buried in the sand of the desert where men and animals have died in agonizing search for water.

But it is not enough to provide ourselves with a quantity of food and drink. There must be enough for the proper nourishment of the body, for restoring waste tissues, and for providing heat and energy. The food and drink must all be clean, nourishing, and pure in order to safeguard our health.

What are the differences in the nutritive value of foods? In our study of food in relation to the body, we discovered that food contained elements of nourishment of vital importance to the health and well-being of the body. The elements of nourishment are found in all food products, but in varying proportions. The four principal elements of nutrition are starches and sugars, together known as carbohydrates; protein, consisting principally of nitrogen, sulphur,

hydrogen, carbon, and oxygen; fat or oil, found chiefly in meats, nuts, milk, and in smaller quantities in many other foods; and mineral substances, among which the most important are phosphorus, sulphur, chlorine, lime, iron, magnesia, salt, soda, and potash. There are other substances, such as the acids in fruits, and

The careful mother serves proper foods in proper proportions

the condiments, or seasonings, which, although less nourishing, aid digestion, because they make the food more pleasant to our taste. In addition we must not forget the vitamines that play such an important part in nutrition and in preventing disease.

How do we secure the elements of nutrition in the proper proportion? The body requires all these elements of nutrition, and, what is more

important, in such proportion as best to serve its needs. We may depend to a great extent on instinct in securing these food elements in the proper proportion, for, in some mysterious way, a desire will grow for this or that special food according to the body's needs for the kind of nourishment it contains. Our sense of taste also leads us to choose a *variety* of foods. So, as a rule, we can be sure that with an abundance and a variety of pure foods before us, we will, in most cases, instinctively select from them in such a way as best to serve the functions of the body. Children may depend upon those who provide for them to be given the proper foods in the proper proportions.

What have we learned about the various articles of food? We have learned to classify foods according to the elements of nourishment they contain. Those that contain carbohydrates in large proportions are known as starch or sugar foods. Among the most important starch foods are the cereals, potatoes, sago, cassava, and taro. The sugar foods are milk, vegetables, and fruits. Under this head also come sirups, candies, and confections, and sugars extracted from sugar-bearing plants, like sugar cane and the sugar beet.

The important protein foods are meats, eggs, peas and beans, and cereals. The principal

sources of fat or oil in our foods are meats, nuts and seeds, and milk. The minerals are present in varying quantities in most foods.

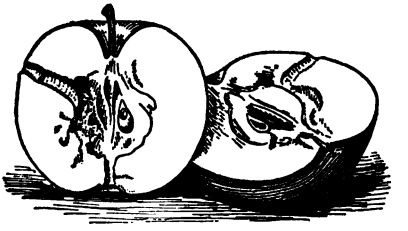
In our study of foods we have also learned the importance of condiments and fruit acids in the digestive processes because of their power to excite the activities of the digestive organs in secreting digestive fluids. The value of condiments depends upon the care with which they are added in the preparation of foods. We have read (pages 23, 24) that natural foods contain certain life-promoting elements which render them more wholesome. These substances are called *vitamines*. They exist particularly in the bran of cereals, in the skins of fruits and

A plate of fruit. Fruit acids aid digestion

vegetables, in milk, and in yeast. They are necessary to health. They are injured by alkalies and by intense heat.

What have we learned about the preparation of foods? We have learned that in the preparation

of wheat and corn for food, the *whole* grain should be ground fine in order to retain all its important nutritive elements. Most fruits are best when eaten raw, though great care must be taken to see that they are thoroughly clean and without worms or dangerous organisms. Fruits that have been sprayed with poisonous bodies should be peeled. Some fruits may be made more edible and digestible by cooking. Meats are most wholesome when properly cooked. The cooking should be done at as low a temperature as possible in order not to injure the vitamines. Meats may also be preserved in various ways, though fresh meats are always to be preferred. The dangers of cold storage have been impressed upon us, and also the danger of using harmful ingredients and preservatives in the preparation of such foods as canned or preserved meats, vegetables, and fruits.



A worm-eaten apple

What we have learned about beverages. Human beings need a great deal of water in addition to that in the food itself. Water, we have already been told, is the natural beverage given to

mankind to quench his thirst, and thirst is nature's best way of telling us the body needs water. But care should be taken to avoid drinking polluted water or water coming from a source exposed to dangerous bacteria. We should also be careful not to drink water that is very cold.

We have learned that coffee is the fruit of a small tree growing in the tropical regions, and that the coffee berry must be roasted in order to give it its flavor. What we know as tea is the dried leaf of a plant growing in warm countries. Both tea and coffee contain a harmful substance known as an alkaloid. In tea the substance is called theine; in coffee, caffeine. But caffeine is the word commonly used for both. Alkaloids are very injurious to the digestive organs, and belong to an extremely dangerous class of such habit-forming drugs as cocaine, morphine, and nicotine. Children should never drink coffee, tea, cocoa, chocolate, nor so-called soft drinks like coca cola, which contain caffeine.

We have also learned what alcoholic drinks and so-called soft drinks are, and that those which contain dangerous substances should be avoided.

The tobacco evil. In connection with the study of habit-forming drugs in beverages we have been warned also of the evils of the tobacco habit. The use of tobacco in any

form, but in particular the form of cigarettes, is especially harmful during the growing period, when its effects are more marked. It retards the growth of the bones, dulls the brain, and robs the blood of needed oxygen by weakening the heart's action. It also injures the white blood corpuscles so that they cannot so well protect the body from incoming disease germs.

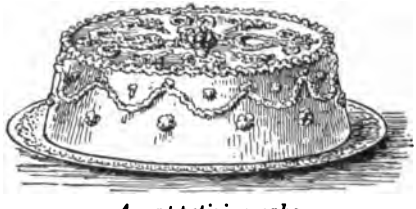
Importance of right habits of eating and drinking. In our study of air we learned that we must have an abundance of good, pure air in order to keep in good health. We also learned that the value of air to functions of the body depends on *how* we breathe it. In our study of food and drink we learned the importance of an abundance and variety of pure food and drink and that the value of food and drink to the functions of the body depends much on *how* we eat and drink.

Health habits in eating. The first care that we must exercise in regard to food is its selection. Though our chief aim in choosing food should be to provide the body with the nutritive elements it needs, we may consult our taste up to a certain point. It is not necessary for any one to eat food that he does not care for just because it contains the nutritive element that he needs. There is such a great variety of foods that a person can easily find one that contains the

necessary elements of nutrition and that also suits his taste.

The attractiveness of food has a direct influence on the digestive processes. Both the sight and taste of a food that we like causes the digestive fluids to flow abundantly and such food will be digested with ease. But if we eat food that we do not like or food prepared in an unattractive way, it will be given a sorry welcome in our digestive organs. The glands will throw out their fluids less freely, and we are liable to have a bad attack of indigestion.

What danger is there in selecting food according to our likes and dislikes? In eating food that we like extremely well, there is great danger of eating it in too large quantities, or, we may be tempted to eat that certain kind of food only. It is then that we must exercise our good habits of temperance and self-control. Cake, for instance, is so appetizing to many that they are tempted to make a meal of cake only, or to cram their stomachs with cake after they have already eaten a sufficient amount of other food.



An appetizing cake

Such habits are very dangerous. If we eat

one kind of food only, we may not get the variety of food elements our bodies must have. The ration will be unbalanced, we may get either too much protein, or too much starch or sugar, or too much fat or oil, or too little mineral substance. Our bodies will be deprived of some elements they need, and as a consequence some tissue or organ may be injured or arrested in its development.

If certain elements are supplied in too large quantities, the organs will be overworked in their effort to get rid of the excess. If we eat such foods as cake or pastry after a meal and in so doing cram our stomachs too full, the digestive process will be burdened with a lot of useless material, the food will not be properly digested, and our bodies will not get the nourishment they need.

What is the danger of eating candy and sugar? Candy is not a natural food; that is, candy contains far more sugar than naturally exists in any food product except honey. The normal appetite for sugar should be content with sugar as it is found in fruits, vegetables, milk, and other products. The eating of candy or sugar in concentrated form causes an unnatural appetite for it. The habit is almost as bad as the habit of using narcotics. A child should not be allowed to acquire what is called a "sweet

tooth," for the eating of much sugar is very dangerous. An excess of sugar in the body may promote a disease called diabetes. We have also read (pages 142–143) how, in eating candy, the child is deprived of those elements which are suitable for building bone and teeth.

Nuts are also commonly eaten in too large quantities. This unbalances the ration. Nuts contain much oil and protein, and the body receives more than the correct proportion of these special food elements.

The danger of eating between meals. Worst of all, many such appetizing foods are eaten between meals. To put food into the stomach while the digestion of other food is in progress disturbs the whole process. The new food mixes with the partly digested food. The digestive process starts all over again, and the partly digested food must remain in the stomach longer than it should. Besides, the digestive organs are thus kept constantly at work, and do not get the rest they need.

Eating between meals overworks the digestive organs

We know how our muscles sometimes need rest. In just the same way the digestive organs need rest. The stomach deserves an occasional Sabbath.

What are some good habits to form in eating? In all that we have read we see that it is very necessary to form certain health habits in eating: First, in selecting food; secondly, in preparing it for eating; thirdly, in setting the hours at which to eat; and, fourthly, in the quantity eaten.

We must first select food that we know is good for us, that will help build our bodies and provide us with heat and energy. It must be in sufficient variety to give us the correct proportion of food elements. Finally, we must exercise temperance in selecting foods that taste extremely good, like cake, pastry, or candy. Since young children cannot know what is good for them it is the duty of parents to find out and of the children to abide by their decisions.

Great care is necessary to be sure that our food is clean. Raw foods must be thoroughly washed to remove germs and impurities. They must be thoroughly inspected so as to avoid dangerous insects or worms, which very often infest such foods as fruits, nuts, vegetables, and cereals.

In the preparation of foods we must avoid

using condiments to excess. Used in excess, condiments will injure or destroy our sense of taste and cause harm to our digestive organs. Used in moderation, they will aid the process of digestion. Foods also must be properly cooked.

We must eat at regular intervals, that is, at certain fixed hours. Thus the digestive organs will know when to get ready for their work, and be in a condition to do it thoroughly. Eating between meals upsets the regularity of the body's processes. The digestive organs become overworked, and health is injured.

The habit of temperance in eating. We find that the habit of temperance is a very valuable habit. We may apply it to almost everything we do. Temperance in eating is moderation exercised both in eating too much or in eating too little. When we play we must not play too much, neither must we play too little. In both extremes there is danger. If you eat until you feel stuffed, it means that you *are* stuffed. In other words, your stomach is so full that it is stretched or distended. In that condition it cannot do its work of digestion properly. On the other hand, if you do not eat enough, the body is deprived of its needed nourishment.

The relation of food to work and exercise. We have read how foods provide us with heat and energy. Oils and carbohydrates especially do

this. Proteins provide chiefly material for rebuilding worn-out tissues. When we work or exercise we are wearing out tissues. These must be rebuilt. We must also have a greater store of heat and energy. Thus we see that if we do much work, or if we get much exercise, it is necessary to provide our bodies with material to supply the demand for heat, energy, and the rebuilding of worn-out tissues.

But if we do not work or exercise, we do not need so much of these materials. If, then, we do take large quantities of them in our food, the excretory organs must work harder to break them up and send them out of the body. In this way a greater burden is placed on these organs than they should have for their health and our well-being.

So we see that we must regulate our food supply according to the amount of work we do. If we do a small amount of work or take little exercise we must lessen accordingly the amount of heat- and energy-forming material in our food. If we do a great deal of work or exercise much, we must increase it.

The value of exercise in relation to the digestive organs. We have learned how play and exercise develop muscles and give new life and energy to all organs of our bodies. Exercise and play require heat, energy, and tissue-building material.

To supply these things the activity of the digestive organs is increased, the process of digestion is hastened, the blood flows faster, carrying the needed elements, and we get what is called an appetite. Every function of the body receives benefit. As a result, we study better, work better, play better, and in every way feel better.

Chopping kindling is a healthful exercise

We must, of course, remember the warning to be temperate, and not to risk the injuries that may result from too violent or too dangerous play or exercise. Prolonged exercise and play will tire not only the muscles of our arms and legs, but the internal organs as well. Thus we should never eat immediately before work or play. Rest for about a half hour before eating and give your digestive organs time to prepare for a new supply of food.

Health habits in drinking. It is very important to form health habits in drinking. The

beverages we use, their quality and quantity, and the time when they are taken into the stomach, all have an influence on our health and well-being.

We have learned that pure drinking water is the best beverage we can use. Milk is also a very healthful drink, but milk is regarded rather as a food than as a beverage for quenching thirst.

We have also learned that we should avoid some of the so-called soft drinks, because of the injurious substances used in making them. Alcoholic drinks are exceedingly dangerous, not only because of the injurious effect on the internal organs, but because their use tends to establish a desire for more and more of such drinks. Finally, the person who continues to use them becomes utterly ruined in mind and body. Many persons believe that, if used in moderate quantities, alcoholic drinks are not dangerous. It is true that the effects are not felt immediately. But as time passes, the alcohol gradually weakens the organs of the body, the blood loses its power to resist diseases, and the person falls a victim, sooner or later, to some disorder which might have been avoided if he had never permitted himself to become a user of alcoholic beverages.

We know the danger of such drinks as coffee, tea, and cocoa. No child should be given any

of these beverages. The effect of the caffeine contained in these drinks is slow, but it is sure, at some time or other, to make itself felt. The child becomes "nervous."

The health habit we should establish in choosing beverages is to select only water or milk, being certain that they are clean and pure; that is, that they contain no dangerous germs or bacteria. We should drink whenever we feel thirsty, but not in quantities larger than necessary to quench our thirst.

The drinking of water at a meal should take place either before eating or immediately after we are through eating. We should not take much water with each bite of food, though recent experiments indicate that in some instances water with the meals appears to be beneficial. It would probably be better, however, to take it immediately after the meal. When much liquid is drunk, the activity of the salivary glands is decreased, and the food is not so well mixed with the saliva, a substance that is necessary in the process of digestion. Another danger of drinking with each mouthful of food is that the food is then gulped down without sufficient chewing, and the stomach receives it in such large chunks that it is with difficulty dissolved and digested.

But water is very necessary to the proper

digestion of the food in the stomach and the movement of the food in the intestines. It is therefore advisable to drink water rather freely before or immediately after eating. We must remember that three fourths of the quantity we eat and drink should be water.

A very bad practice in the use of beverages is to put ice in them. We have learned that the temperature of the water we drink should not be lower than fifty-five degrees and not higher than sixty-five degrees. Ice-cold beverages are very harmful. The process of digestion is delayed until the stomach has regained its normal temperature. Besides, the purity of the ice we get is very doubtful. Natural ice may be full of dangerous bacteria.

A glass of ice water

It is a good plan, whenever drinking water is very cold, as it is when iced, to sip it so slowly that it will have time to take on a more normal temperature while in the mouth.

Water in fruits and vegetables. A very healthful way of supplying the body with some of the water it needs is to eat an abundance of ripe fruits and juicy vegetables. The person who does this does not need to drink so much water as those who do not eat them. But chil-

dren under five years of age should eat fruits and vegetables sparingly, and infants not at all, for their digestive organs are not yet ready to take care of such foods. The juices of fruits may also be used to flavor water, making very delicious and healthful beverages with which to quench thirst. Such beverages should not be sweetened. Sugar so added to the natural sugar already in the fruit destroys the thirst-quenching property and unbalances the ration.

Food and drink for a growing child. What conclusions may we then form as to the best food and drink for the growing child over five or six years of age? The best food that a growing child can be given, in addition to milk, is bread made from whole-wheat flour, vegetables, nuts, fruits, and, at times, small quantities of fresh meat. For beverages he should be given pure, clean, fresh milk from healthy cows, and pure drinking water. With this variety of food and drink the child will get all the food elements that are necessary to nourish his body and properly promote growth. If he chews his food thoroughly, and if habits of regularity are established, with temperance in eating and drinking, the child will be in a fair way to build a strong and healthy body, to have regular and sound teeth, and to insure for himself a happy and useful future.

QUESTIONS TO HELP THE PUPIL

1. Why do we need food and drink? 2. Of what must we be careful in regard to the quantity and quality of our food and drink? 3. Are all foods alike in nutritive value? 4. What are the four principal elements of nutrition? 5. What other substances that furnish nutrition to the body are found in foods? 6. Name the mineral substances found in foods. 7. What aids us in choosing our foods? 8. What aids us in choosing a variety of foods? 9. Name some foods containing a large proportion of sugar. 10. Name some important starch foods. 11. What are the important protein foods? 12. What are the principal sources of fat or oil in foods? 13. In what foods are minerals found? 14. What are the uses of condiments and fruit acids in digestion? 15. How should condiments be added to foods? 16. In what foods do vitamines principally exist? 17. May the vitamines be injured? how? 18. How should wheat and corn be ground in order to be most valuable as food? 19. What care should be taken when eating raw fruits? 20. At what temperature should cooking be done? why? 21. What is the danger of prolonged cold storage? 22. What have you learned about the coffee berry? 23. Where does the tea plant grow? 24. What harmful substance is contained in coffee? in tea? 25. What other drinks are injurious to the health? 26. How does the use of tobacco affect the growth and health of the body? 27. What is the first care to be exercised in regard to food? 28. What is the effect on the digestive processes when we eat food that we like? 29. What is the effect of eating food that we do not like? 30. What is the result of eating one kind of food only? 31. What danger results from eating too much candy? 32. What danger results from eating too many nuts? 33. What is the danger of eating between meals? 34. Why should we eat at certain fixed hours every day? 35. What are the four health habits to form in eating? 36. What is the danger in using condiments to excess? 37. What is meant by temperance in eating? 38. What food elements provide us with heat and energy? 39. What food elements

provide us with material to rebuild worn-out tissues? 40. Why do we need more proteins, oils, and carbohydrates when we work hard or take much exercise? 41. What danger results from eating much and exercising little? 42. Why is exercise beneficial? 43. Why should we not eat immediately before or after work or play? 44. About how long should we rest? 45. What drinks should we avoid and why? 46. What health habit should children establish in choosing beverages? 47. How much should we drink? 48. When should the drinking of water at a meal take place? 49. Why is it well to drink freely at such a time? 50. What are the two reasons for not taking a drink with each mouthful of food? 51. What is a healthful way of supplying the body with some of the water it needs? 52. Why should water flavored with fruit juices not be sweetened? 53. What is the danger of ice-cold drinks? 54. What is a good plan in drinking very cold water? 55. What is the best food and drink for the growing child?

THE VOCABULARY

[The diacritical marks used to indicate pronunciation agree with the latest edition of Webster's New International Dictionary.]

acidity (*ȧ* sĭd'ĭ tĭ)
activator (ăk'tĭ vā tēr)
adulterate (*ȧ* dŭl'tēr āt)
to make impure by the addition of a foreign or inferior substance
alimentary canal (ăl'ĭ mĕn'*tȧ* rĭ kȧ năl')
the canal or tube which digests the food and absorbs the nourishment for the whole body
alkali (ăl'kȧ lī)
alkaline (ăl'kȧ līn)
having the qualities of an alkali
alkaloid (ăl'kȧ loid)
amine (ăm'ĭn; *ȧ* mēn')
anaemia (*ȧ* nē'mĭ *ȧ*)
a disease of the blood characterized by a deficiency in the red corpuscles
appendicitis (*ȧ* pĕn'dĭ sĭ'tĭs)
inflammation of the appendix
arsenic (ār'sē nĭk)
an extremely poisonous substance

bacteria (băk tē'rĭ *ȧ*)
bacteriologist (băk tē'rĭ ŏl'ŏ jĭst)
one who makes a special study of bacteria
benzoate (bĕn'zō āt)
beri-beri (bĕr'ĭ-bĕr'ĭ)
beverage (bĕv'ēr āj)
a liquid for drinking

cacao (kȧ kā'ō; kȧ kä'ō)
caffeine (kăf'ē ĭn; kaf'ē ēn)
Camembert (kȧ'mäN'bâr')
Capsicum (kăp'sĭ kŭm)
carbohydrate (kär'bō hī'drāt)
carbon (cär'bŏn)
casein (kā'sē ĭn)
cassava (kȧ sä'vȧ)
champagne (shăm pān')
chlorine (klō'rĭn; klō'rēn)
a poisonous gas with a disagreeable odor
chlorophyl (klō'rō fĭl)
citric (sĭt'rĭk)
cocaine (kō'kȧ ĭn; kō' kȧ ēn)
condiment (kŏn'dĭ mĕnt)
corpuscles (kôr'pŭs'lz)
minute particles, especially those which make up the solid part of the blood

diabetes (dĭ'*ȧ* bē'tēz)
a disease of the kidneys often marked by an excess of sugar in the urine
distended (dĭs tĕnd'ĕd)
stretched in all directions

excretory (ĕks'krē tō rĭ; ĕks krē'-tō rĭ)

fungi (fŭn'jī)

gelatin (jĕl'*ȧ* tĭn)
a jelly-like substance obtained from certain animal tissues
geologist (jē ŏl'ŏ jĭst)
one who makes a special study of the history of the earth as recorded in the rocks
glucose (glōō'kōs)
gluten (glōō'tĕn)

Hawaiian Islands (hä wī'*y*ăn ī'lăndz)
humus (hū'mŭs)
hydrogen (hī'drō jĕn)
one of the chief elements in water

intestines (ĭn tĕs′tĭnz)
the portion of the alimentary canal known commonly as the bowels

lactose (lăk′tōs)

magnesia (măg nē′zhĭ *ȧ*; măg nē′-zh*ȧ*)
a light, earthy white chalky substance used in medicine
malic (mā′lĭk; măl′ĭk)
maltose (môl′tōs; mŏl′tōs)
Mocha (mō′k*ȧ*)
monodiet (mŏn′ō dī′ĕt)
morphine (môr′fĭn; môr′fēn)
muscle (mŭs′′l)
muscular (mŭs′kū l*ȧ*r)
pertaining to the muscles

narcotic (när kŏt′ĭk)
any drug which dulls the senses; sometimes used to allay pain or produce sleep
nicotine (nĭk′ō tĭn; nĭk′ō tēn)
nitrogen (nī′trō jĕn)
the most important element in the air, forming almost four fifths of it
nux vomica (nŭks vŏm′ĭ k*ȧ*)
a drug which has a stimulating effect on the heart

obesity (ō bĕs′ĭ tĭ)
olfactory (ŏl făk′tō rĭ)
oxygen (ŏk′sĭ jĕn)
one of the elements of the air, forming about one fifth of it; also an important element of water

pancreas (păŋ′krē ăs)
parasitic (păr *ȧ* sĭt′ĭk)
pellagra (pĕ lăg′r*ȧ*; pĕ lā gr*ȧ*)
pepsin (pĕp′sĭn)
one of the digestive secretions of the stomachs of the higher animals
phagocyte (făg′ō sīt)
phosphate (fŏs′fāt)
phosphoric acid (fŏs fŏr′ĭk ăs′ĭd)
phosphorus (fŏs′fŏr *ŭ*s; fŏs′fōr *ŭ*s)
pneumonia (nū mō′nĭ *ȧ*)
inflammation of the lungs
potash (pŏt′ăsh)
protein (prō′tē ĭn)
pungency (pŭn′jĕn sĭ)
sharp, biting, stinging taste and smell

quern (kwûrn)
a primitive mill for grinding grain, consisting of two circular stones, the upper one being turned by hand
quinine (kwĭ′nĭn; kwĭ nēn′)

rancid (răn′sĭd)
ration (rā′sh*ŭ*n)
an amount or allowance of foods sufficient for a certain period
Rio de Janeiro (rē′ō dā zh*ȧ* nā′-rō)

sago (sā′gō)
salivary (săl′ĭ vȧ rĭ)
pertaining to saliva; the salivary glands secrete saliva
silica (sĭl′ĭ k*ȧ*)
soluble (sŏl′ū b′l)
sorghum (sôr′g*ŭ*m)
Stassfurt (shtäs′fōōrt)
sterile (stĕr′ĭl)
stimulant (stĭm′ū l*ȧ*nt)
that which produces increased action of any organ
succulent (sŭk′ū l*ȧ*nt)
sulphur (sŭl′f*ŭ*r)
sustenance (sŭs′tē n*ȧ*ns)
that which supports life
syringe (sĭr′ĭnj)
a small hand pump for injecting liquids into animal bodies

tannin (tăn′ĭn)
taro (tä′rō)
tartaric (tär tăr′ĭk)
tendon (tĕn′d*ŭ*n)
a tough cord or band of

inelastic, white tissue connecting a muscle with some other part, as a bone

theine (thē′ĭn; thē′ēn)

theobromine (thē′ō brō′mĭn)

tuber (tū′bēr)
a short, thickened portion of an underground stem, as the potato

tuberculosis (tū bûr′kū lō′sĭs)
a disease, primarily of the lungs, caused by the tubercle bacillus and marked by the formation of tubercles or minute growths which destroy the tissues

vitamine (vī′tȧ mĭn)

vitriol (vĭt′rĭ ȧl)
a chemical substance which is very caustic (burning)

zein (zē′ĭn)

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